Australian Government
Department of Agriculture, Fisheries and Forestry

Ms Christel Leemhuis
General Manager, Science and Risk Assessment Branch
Food Standards Australia New Zealand
PO Box 5423
KINGSTON ACT 2604

Dear Ms Leemhuis

I am writing to you to request advice on the risks associated with enoki mushrooms for human consumption. This request is per section 6.1.1(a) (iii) of Schedule 2 (An arrangement for coordination of procedures and communication of imported food issues) to the Memorandum of Understanding between the Department of Agriculture, Fisheries and Forestry and the Department of Health and Aged Care.

Following recent cases of *Listeria monocytogenes* illness being associated with the consumption of uncooked enoki mushrooms both overseas and in Australia, the department wants to ensure adequate measures are in place to manage the food safety risks associated with imported enoki mushrooms for human consumption. This advice is separate to the advice currently being provided to the department on high risk horticulture as this advice is specific to ready-to-eat fruits and vegetables. As per the department's previous investigation and response to illness associated with imported enoki mushrooms, these mushrooms are not intended to be eaten without cooking.

In 2019, both the United States of America (USA) and Canada linked historical and recent cases of listeriosis with consumption of enoki mushrooms from the Republic of Korea. This link was made through whole genome sequencing. Both countries have undertaken recalls, as a result of this link. In the USA between 2016 and 2019, 36 cases of listeriosis were identified resulting in 4 deaths. In Canada between 2017 and 2019, 6 cases of listeriosis were identified.

The department confirmed, via the International Food Safety Network (INFOSAN) emergency contact points in the USA and Canada, that the supplier/producer of enoki mushroom in the Republic of Korea, implicated in the USA outbreak, also supplied enoki mushroom to the Australian market.

As a result of these recalls and confirmation of Australia's imports of the implicated enoki mushrooms, OzFoodNet investigated whether any cases in Australia were potentially linked. Six cases were identified as being related to the USA outbreak through whole genome sequencing, including one death.

The importer of Green Co. enoki mushrooms, Choi's Mushrooms in NSW, recalled this product. Consumers were advised by Food Standards Australia New Zealand to cook enoki mushrooms before consumption.

The department applied holding orders on the supplier/producer of enoki mushrooms from the Republic of Korea, Green Co. to ensure future consignments of enoki were referred to the Imported Food Inspection Scheme for inspection, including checking the label to ensure cooking instructions were clearly stated.

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agriculture.gov.au
ABN 34 190 894 983

Following increased testing of enoki mushrooms traded internationally, multiple recalls have been conducted. Recent data on international recalls of enoki mushrooms for *Listeria monocytogenes* contamination can be viewed at **Attachment 1**.

As this advice will be used to inform possible changes to the monitoring of enoki mushrooms under the *Imported Food Control Act 1992*, we would be grateful if it could be finalised promptly. If the department can provide additional information to assist FSANZ with this request, please contact Ms s. 22(1)(a)(ii) via email at s. 22(1)(a)(ii) @aff.gov.au.

Yours sincerely

Ms Vikki Fischer
Assistant Secretary
Pathway Policy – Travellers, Mail and Imported Food
Department of Agriculture, Fisheries and Forestry

22 December 2022

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

From: Mulhearn, Christine
Sent: Friday, 18 August 2023 12:17 PM
To: Ag Media; s. 22(1)(a)(ii)
Cc: Black, Tom; s. 22(1)(a)(ii) ; s. 22(1)(a)(ii) ; s. 22(1)(a)(ii)
Subject: RE: MEDIA ENQUIRY - due 12pm: Media Inquiry [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

Happy with this response

Christine

From: Ag Media <Media@aff.gov.au>
Sent: Friday, August 18, 2023 12:17 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; Ag Media <Media@aff.gov.au>
Cc: Mulhearn, Christine <Christine.Mulhearn@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: MEDIA ENQUIRY - due 12pm: Media Inquiry [SEC=OFFICIAL]

Thanks so much s. 22(1)(a)(ii), this looks excellent and thank you for the swift turnaround.

Christine, can you please let me know if you're happy with the below response?

Kind regards,
s. 22(1)(a)(ii)

s. 22(1)(a)(ii)
Media Officer | Media |
s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Communication and Media Branch
Corporate and Business Division

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>
Sent: Friday, August 18, 2023 12:15 PM
To: Ag Media <Media@aff.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: MEDIA ENQUIRY - due 12pm: Media Inquiry [SEC=OFFICIAL]
Importance: High

Hi s. 22(1)(a)(ii)

Please see response below. It has not been cleared yet by Christine.

- **What checks are done on dehydrated mushrooms entering the country to make sure they are safe?**

The department is responsible for administering the *Imported Food Control Act 1992*. Under this Act, there are penalties in place for persons who import food for human consumption that is unsafe and/or non-compliant with Australia's food standards, primarily the Food Standards Code.

Schedule 23 of this Code lists plants and fungi that are prohibited from being sold as food, or as an ingredient in food. This includes *Amanita* spp. To verify compliance with this prohibition, importers (or brokers acting on behalf of importers), must declare if the imported plant or fungi is prohibited under this schedule - Prohibited plants and fungi - DAFF (agriculture.gov.au). If it is, the shipment will be failed and not permitted entry.

All other fungi are classified as surveillance (or low risk) foods and each shipment has a 5% chance of being referred for inspection. At inspection, the mushrooms will be visually assessed for signs of damage, infestation and deterioration and a label check will be conducted. This will include verifying the import is not a prohibited fungi.

- **Have there been any other potential incidents of poisoning from imported dehydrated mushrooms?**

  The department is not aware on any incidents that have been definitively linked to imported dehydrated mushrooms. The department regulatory monitors international food incidents, alerts and recalls and following a search of our systems (from the beginning of 2022) can find none associated with mushroom toxicity linked to dehydrated mushrooms.

- **Is the department investigating the supply chain at all?**

  No. The department is not aware of any evidence that imported dehydrated mushrooms have been associated with any recent illnesses or deaths in Australia. However, if such evidence existed, Australia has robust systems in place to quickly respond to food incidents.

Kind regards
s. 22(1)(a)(ii)

From: Ag Media <Media@aff.gov.au>
Sent: Friday, August 18, 2023 10:58 AM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>
Cc: Mulhearn, Christine <Christine.Mulhearn@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; Ag Media <Media@aff.gov.au>
Subject: MEDIA ENQUIRY - due 12pm: Media Inquiry [SEC=OFFICIAL]

Good morning,

We've had a media enquiry from the Guardian:

- I am seeking some information on the supply chain of dried goods, specifically mushrooms given the recent concerns.
- What checks are done on dehydrated mushrooms entering the country to make sure they are safe?
- Have there been any other potential incidents of poisoning from imported dehydrated mushrooms?
- Is the department investigating the supply chain at all?

I'm sorry to do this to you, but the journalist has provided a deadline of 1pm today. Would it be possible to have a response by 12pm?

Kind regards,
s. 22(1)(a)(ii)

s. 22(1)(a)(ii)
Media Officer | Media |

s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Communication and Media Branch
Corporate and Business Division

From: s. 47F(1) <s. 47F(1)@theguardian.com>
Sent: Friday, August 18, 2023 10:43 AM
To: Ag Media <Media@aff.gov.au>
Subject: Media Inquiry

Hi,

I am seeking some information on the supply chain of dried goods, specifically mushrooms given the recent concerns.

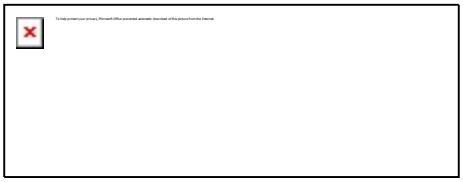
What checks are done on dehydrated mushrooms entering the country to make sure they are safe?

Have there been any other potential incidents of poisoning from imported dehydrated mushrooms?

Is the department investigating the supply chain at all?

Thank you,

---
s. 47F(1)
Reporter
The Guardian | Australia
---
s. 47F(1)
s. 47F(1)@theguardian.com
---
twitter: s. 47F(1)



s. 47F(1)

theguardian.com/au

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Friday, 18 August 2023 3:52 PM
To: s. 22(1)(a)(ii)
Subject: RE: MEDIA ENQUIRY - due 4pm: URGENT MEDIA REQUEST: Under Investigation with Liz Hayes [SEC=OFFICIAL]

Thanks s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Sent: Friday, August 18, 2023 3:47 PM
To: Mulhearn, Christine <Christine.Mulhearn@aff.gov.au>
Cc: Black, Tom <Tom.Black@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>
Subject: RE: MEDIA ENQUIRY - due 4pm: URGENT MEDIA REQUEST: Under Investigation with Liz Hayes [SEC=OFFICIAL]
Importance: High

Hi Christine

Responses to these additional questions (Q1,2,3) for Channel Nine, for your clearance by 4PM please.
Q4 and Q5 responses cleared earlier today.

- **Q1 . What are the regulations for Australian businesses who import Chinese sealed mushroom packages into Australia?**

  Certain species of plants/fungi that contain drugs or precursors of drugs are prohibited under Customs (Prohibited Imports) Regulations 1956. If permitted, imported mushrooms must also meet Australia's strict biosecurity import conditions regulated under the Biosecurity Act 2015. The biosecurity import conditions for mushrooms are published on the department's database BICON. Only certain species of mushroom are permitted to be imported under the Biosecurity Act 2015, in order to protect Australia's plants and animals from pest and disease. If the species of mushroom meets biosecurity requirements, imports intended as food for sale are subject to the Imported Food Control Act 1992 (see Q5 for further information).

  Post border, state and territory food authorities regulate food for sale for human consumption, whether domestically produced or imported.

- **Q2. What is the likelihood that death cap mushrooms could be imported from China into Australia?**

  Multiple Acts prohibit the importation and sale of this mushroom in Australia.

  In relation to food for sale, strict penalties apply under the Imported Food Control Act on persons who import unsafe food intended for sale and state and territory food laws also include strict penalties on persons who sell unsafe food whether imported or domestically produced.

  The department is not aware of any evidence that these mushrooms are being imported into Australia from any country.

- **Q3. Have you come across any imports of chinese mushrooms which may have included poisonous varieties such as Death Cap?**

No

- **Q4. Have there ever been cases of imported mushrooms being poisonous?**

  The department is not aware on any incidents that have been definitively linked to imported dehydrated mushrooms. The department regularly monitors international food incidents, alerts and recalls and following a search of our systems (from the beginning of 2022) can find none associated with mushroom toxicity linked to dehydrated mushrooms.

- **Q5. How are dried mushrooms inspected and cleared before being allowed to be sold on Australia shelves?**

  The department is responsible for administering the Imported Food Control Act 1992. Under this Act, there are penalties in place for persons who import food for human consumption that is unsafe and/or non-compliant with Australia's food standards, primarily the Food Standards Code.
  Schedule 23 of this Code lists plants and fungi that are prohibited from being sold as food, or as an ingredient in food. This includes Amanita spp. To verify compliance with this prohibition, importers (or brokers acting on behalf of importers), must declare if the imported plant or fungi is prohibited under this schedule - Prohibited plants and fungi - DAFF (agriculture.gov.au). If it is, the shipment will be failed and not permitted entry.
  All other fungi are classified as surveillance (or low risk) foods and are randomly referred for border inspection. At inspection, the mushrooms will be visually assessed for signs of damage, infestation and deterioration and a label check will be conducted. This will include verifying the import is not a prohibited fungi.

Thank

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Assistant Director | Imported Food
Phone s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @aff.gov.au

Department of Agriculture, Fisheries and Forestry
Residues and Food Branch
Agriculture House, 70 Northbourne Ave, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

From: Ag Media <Media@aff.gov.au>
Sent: Friday, August 18, 2023 3:11 PM
To: Ag Media <Media@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; Mulhearn, Christine <Christine.Mulhearn@aff.gov.au>
Cc: Black, Tom <Tom.Black@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: MEDIA ENQUIRY - due 4pm: URGENT MEDIA REQUEST: Under Investigation with Liz Hayes [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii),

A producer from the same program has added another question to the pile:

- Have you come across any imports of chinese mushrooms which may have included poisonous varieties such as Death Cap?

Sorry to dump this on you, could you please include a response to this question as well?

Kind regards,
s. 22(1)(a)(ii)

s. 22(1)(a)(ii)
Media Officer | Media |
s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Communication and Media Branch
Corporate and Business Division

From: Ag Media <Media@aff.gov.au>
Sent: Friday, August 18, 2023 2:01 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; Ag Media <Media@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; Mulhearn, Christine <Christine.Mulhearn@aff.gov.au>
Cc: Black, Tom <Tom.Black@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: MEDIA ENQUIRY - due 4pm: URGENT MEDIA REQUEST: Under Investigation with Liz Hayes [SEC=OFFICIAL]

Thanks so much s. 22(1)(a)(ii), I really appreciate it.

Kind regards,
s. 22(1)(a)(ii)

s. 22(1)(a)(ii)
Media Officer | Media |
s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Communication and Media Branch
Corporate and Business Division

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Sent: Friday, August 18, 2023 2:00 PM
To: Ag Media <Media@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; Mulhearn, Christine <Christine.Mulhearn@aff.gov.au>
Cc: Black, Tom <Tom.Black@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: MEDIA ENQUIRY - due 4pm: URGENT MEDIA REQUEST: Under Investigation with Liz Hayes [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

I've just spoken to s. 22(1)(a)(ii) about the below. As she has logged off I will draft some words in response to the last two questions.

Kind regards
s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Project Manager | Imported Food
Phone s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @aff.gov.au

Department of Agriculture, Fisheries and Forestry
Residues and Food Branch
Agriculture House, 70 Northbourne Ave, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

From: Ag Media <Media@aff.gov.au>
Sent: Friday, August 18, 2023 1:43 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; Mulhearn, Christine <Christine.Mulhearn@aff.gov.au>
Cc: Black, Tom <Tom.Black@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Subject: MEDIA ENQUIRY - due 4pm: URGENT MEDIA REQUEST: Under Investigation with Liz Hayes [SEC=OFFICIAL]

Good afternoon,

No rest for the wicked! We've had a similar media enquiry from Channel Nine. Suggested responses based on previous enquiry included:

We'd like to request comments for the below questions:

- Have there ever been cases of imported mushrooms being poisonous?

The department is not aware on any incidents that have been definitively linked to imported dehydrated mushrooms. The department regularly monitors international food incidents, alerts and recalls and following a search of our systems (from the beginning of 2022) can find none associated with mushroom toxicity linked to dehydrated mushrooms.

- How are dried mushrooms inspected and cleared before being allowed to be sold on Australia shelves?

The department is responsible for administering the Imported Food Control Act 1992. Under this Act, there are penalties in place for persons who import food for human consumption that is unsafe and/or non-compliant with Australia's food standards, primarily the Food Standards Code.
Schedule 23 of this Code lists plants and fungi that are prohibited from being sold as food, or as an ingredient in food. This includes Amanita spp. To verify compliance with this prohibition, importers (or brokers acting on behalf of importers), must declare if the imported plant or fungi is prohibited under this schedule - Prohibited plants and fungi - DAFF (agriculture.gov.au). If it is, the shipment will be failed and not permitted entry.
All other fungi are classified as surveillance (or low risk) foods and are randomly referred for border inspection. At inspection, the mushrooms will be visually assessed for signs of damage, infestation and

deterioration and a label check will be conducted. This will include verifying the import is not a prohibited fungi.

- What are the regulations for Australian businesses who import Chinese sealed mushroom packages into Australia?
- What is the likelihood that death cap mushrooms could be imported from China into Australia?

If we could have a response by 4pm that would be greatly appreciated, thank you.

Kind regards,
s. 22(1)(a)(ii)

s. 22(1)(a)(ii)
Media Officer | Media |
s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Communication and Media Branch
Corporate and Business Division

From: s. 47F(1) <s. 47F(1)@nine.com.au>
Sent: Friday, August 18, 2023 1:28 PM
To: Ag Media <Media@aff.gov.au>
Subject: URGENT MEDIA REQUEST: Under Investigation with Liz Hayes

Dear DAFF,

I'm a producer with Channel Nine's Series "Under Investigation with Liz Hayes".

We'd like to request comments for the below questions:

- Have there ever been cases of imported mushrooms being poisonous?

- How are dried mushrooms inspected and cleared before being allowed to be sold on Australia shelves?

- What are the regulations for Australian businesses who import Chinese sealed mushroom packages into Australia?

- What is the likelihood that death cap mushrooms could be imported from China into Australia?

Deadline: **TODAY Friday 5:00pm.**

Thank you,

--

s. 47F(1)
s. 47F(1)
s. 47F(1)

M s. 47F(1)
A s. 47F(1)
E s. 47F(1)

Australian Government
Department of Agriculture, Water and the Environment

Imported food incident response form

(IFP-FM419)

Section A: Action required

☒ Holding order (H/O) - Reasonable grounds (Section 15(1)(b) of *Imported Food Control Act 1992* (the Act))

☐ H/O – Extension of emergency (Section 15(4) of the Act)

Previous extension: mm/dd/yyyy to mm/dd/yyyy

Number of extensions:

Date extended to:

☐ H/O - Emergency (Section 15(3) of the Act)

☐ Increasing the rate that risk food is inspected.

Section 18(4) of the Imported Food Control Regulations 2019 provides that the rates may be raised when:

a) one or more batches of the food fail inspection

or

b) an authorised officer believes that the food does not comply with the applicable standards or poses a risk to human health.

(Note: no H/O classification or number is required)

Section B: Reason for response

Include details of the food, notifying organisation (if applicable), if the food has been subject to recall in Australia or internationally and reason, reported illnesses, test(s) to apply and if the producer and product is identifiable in AIMs and/ or the ICS.

On 6 June 2023, a consumer recall was conducted by KO Food Australia on enoki mushrooms imported from Korea - KO Food Enoki Mushrooms (foodstandards.gov.au) due to being labelled with the incorrect best before date resulting in an increased *Listeria monocytogenes* risk. The enoki mushrooms were imported by KO Food Australia.

On 2 June 2023, a consumer recall was conducted by Fruit Perfections on enoki mushrooms imported from Korea - Fruit Perfections Enoki Mushrooms (foodstandards.gov.au) due to contamination with *Listeria monocytogenes* and the absence of instructions to cook the product prior to consumption. The enoki mushrooms were imported by KO Food Australia, on-sold to Sunrise Enterprise, who the on-sold to Fruit Perfection.

HO applied to verify products are labelled with cooking instructions, as required under FSC Standard 1.2.6 - 2(b), and to verify products are date marked, as required under FSC Standard 1.2.5 (3).

Section C: Holding order classification in AIMS

☒ Food recall (REC)

☐ Incident (INC)

☐ Temporary holding order (THO)

☐ Other – provide details

Details	FSANZ recalls number 2023/40 and 2023/42.

Section D: Imported food details

Brand name	Unknown
Country of origin	Republic of Korea
Customs entry number (if known)	Not applicable
Goods description	Enoki mushrooms (fresh)
Importer code	63613128733
Importer name	KO Food Australia Pty Ltd
Producer code/s (if multiple note all)	63613128733
Producer name	Dr Ag Co Ltd
Tariff code (include all 10 digits)	07095900 90
Test (if applicable)*	Labelling
Additional details*	HO applied to verify products are labelled with cooking instructions, as required under FSC Standard 1.2.6 - 2(b), and to verify products are date marked, as required under FSC Standard 1.2.5 (3).

* For further information on completing fields, refer to Work Instruction: *Responding to food incidents involving imported food (IFP-W1411*).

Section E: Holding order number

Holding order number: REC23005 Date: June 2023

Section F: Declaration

Delegate declaration	**Date**
s. 22(1)(a)(ii)	08/06/2023

Delegate of the Secretary appointed under Section 41 of the Act for the purposes of Sections 15 and 16 of the Act.

IFN 01-23 - Listeria monocytogenes in enoki mushrooms

Date of effect: 03/03/2023

Attention

Importers of enoki mushrooms and brokers acting on their behalf.

Purpose

The purpose of this notice is to raise industry awareness of the risk of *Listeria monocytogenes (L. monocytogenes)* contamination in enoki (enokitake) mushrooms being imported into Australia.

Notifications of *Listeria monocytogenes* in enoki mushrooms

Recently, there has been an increase in the number of overseas food incident alerts and notifications concerning enoki mushrooms contaminated with *L. monocytogenes*. The consumption of contaminated enoki mushrooms has been associated with illness and deaths. The increase in notifications has raised concerns in relation to the cultivation and processing of enoki mushrooms.

Importer's responsibility

It is the importer's responsibility to ensure they import food that is safe and suitable for human consumption.

If you import enoki mushrooms, we recommend you ask your supplier to provide you with evidence that the mushrooms have been produced under a food safety management system that effectively identifies and controls foodborne hazards of concern, including *L. monocytogenes*. You must also ensure the product is labelled in accordance with Australia's food standards and that temperature control has been applied during transport and storage for the safety of the food.

Enoki mushrooms are not ready-to-eat and should be fully cooked before being eaten. Instructions for cooking must be included on the label as per clause 2 of Standard 1.2.6 – Information requirements – directions for use and storage of the Australia New Zealand Food Standards Code (https://www.foodstandards.gov.au/code/Pages/default.aspx) .

When enoki mushrooms are eaten raw or undercooked consumers, in particular those at-risk, may expose themselves to becoming sick.

Next steps

The department has asked Food Standards Australia New Zealand for advice on the risks associated with enoki mushrooms for human consumption. Depending on the outcome of that advice, the department will consider if additional risk management measures need to be applied at the border.

We will communicate any further changes to the import requirements for enoki mushrooms as they occur.

Background

Listeriosis is an illness usually caused by eating food contaminated by the bacterium *Listeria monocytogenes*. The bacteria are widely distributed in the environment and can grow in food at refrigeration temperatures. Most people who are exposed to Listeria will only develop mild symptoms, though illness can be severe in those most at-risk. Those at increased risk of illness include pregnant women and their unborn babies, newborn babies, the elderly and people of all ages with weakened immune systems.

Symptoms of Listeriosis can include vomiting, nausea, persistent fever, muscle aches, severe headache and neck stiffness.

Subscribe for updates

Stay updated on changes to the requirements for imported food. Subscribe to the Imported Food Inspection Scheme imported food notices (https://subscribe.agriculture.gov.au/subscribe) .

General enquiries

Call 1800 900 090

Contact us online (/about/contact)

Report a biosecurity concern (/biosecurity-trade/pests-diseases-weeds/report)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d),s. 47F(1)

s. 47F(1)

s. 47F(1)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d),s. 47F(1)

s. 47F(1)

s. 47F(1)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

s. 45(1),s. 47B,s. 47E(d)

OFFICIAL

14.11.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: þ *Yes* ¨ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* can be present in enoki mushrooms and foodborne illness outbreaks have been associated with the consumption of enoki mushrooms, including in Australia • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • A cooking step such as boiling enoki mushroom should eliminate the hazard. However, there is evidence of consumption without adequate cooking. • Available evidence indicates that the prevalence and level of *L. monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered

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General description
mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013). Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. Approximately 43% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 33% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly indicating that consumption of enoki mushrooms has increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than other sectors of the population. Those unfamiliar with enoki mushrooms may still consume them occasionally and may consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including from China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *L. monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (e.g. collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. To minimise contamination of enoki mushrooms with *L. monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). *L. monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C:

Commented s. 22(1)(a)(i) Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

Commented [s. 47F(1)]: I have moved the text. I am not aware of any specific routes of contamination by Listeria during production. It could well enter the premises on equipment or people depending on what PPE or sanitization at the entry to the facility is available. Once in the production space it would be difficult to eliminate or control particularly if you have not been completing environmental or product testing on site.

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1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki mushrooms stored at 5°C for 30 days with increasing growth rates at higher temperatures. Thus, if *L. monocytogenes* is present on the enoki mushrooms when packaged and the product has an extended shelf-life (> 14 days), it has the potential to grow to high numbers before consumption, even if refrigerated. Application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly. However, depending upon the initial contamination level, combined with longer storage times at temperatures of 5°C to ambient for both transport and storage, it is likely that the concentration of *Listeria* could increase to levels of 10^5-10^7 cells/g. This would constitute a public health and safety risk, particularly for vulnerable populations (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *L. monocytogenes* numbers occurring over a period of a month. Consumer advice varies on the suitability of enoki mushrooms to be consumed raw. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). The US Mushroom Council states that enoki mushrooms can be consumed either eaten raw in salads or as part of a sandwich or can be used as an ingredient in soups and stocks (US Mushroom Council 2021). However, traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. As there is evidence these mushrooms are being used in non-traditional ways (e.g. salads, stir fries), they present an increased risk for listeriosis. There are no specific measures reported for the control of *L. monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. **Risk assessment by FSANZ to inform risk management** A risk assessment was undertaken by FSANZ to determine if a significant public health and safety risk is posed by *L. monocytogenes* and imported raw enoki mushrooms, and to provide scientific justification for risk management measures that can be applied to provide an appropriate level of risk for consumers. This also included consideration of applying a Performance Objective at the Australian border to achieve an appropriate level of risk. A Performance objective (PO) is defined as the maximum frequency and/or concentration of a hazard in a food at a specified step in the food chain before the time of consumption that provides or contributes to an appropriate level of risk. The semi-quantitative risk assessment, estimated risk of illness to Australian consumers based on assumptions that: • all imported enoki is refrigerated at 5°C post border • has a storage time before consumption of between 14 and 55 days post border entry • is cooked before consumption, and • where cooking is 99% effectiveness (ie "usually eliminates the hazard"). This modelling estimated a medium to high risk of illness if 10% of imported enoki was contaminated at levels of 1,000 CFU/g where the serving size was 100g. Additionally, a high risk was estimated if 15% of imported enoki was assumed to be consumed raw between 14 and 35 days post border entry. The outcomes of the risk assessment also demonstrated that: • labelling is required to reduce risk but alone is insufficient to reduce the public health and safety risk posed by imported enoki under reasonably foreseeable conditions of use; • enoki must be refrigerated through-chain once packaged, and must be labelled to be refrigerated and cooked thoroughly to reduce the risk of illness from this product; • risk increases with a longer shelf-life. Product at the Australian border with a remaining shelf-life datemarked >35 days should not be considered safe and suitable unless evidence validating the date-marking can be provided. Additionally, food businesses should ensure that any and all date-marking are validated; and • applying a PO of *L. monocytogenes* not detected in five 25g samples of enoki from a lot , even if appropriate labelling is present, can contribute to reducing risk to an appropriate level. Enoki mushrooms can be considered a potentially hazardous food due to the potential presence of *L. monocytogenes* that can grow on this product during storage. Cooking time/temperatures required to achieve a 6D reduction of *L. monocytogenes* are 65°C for 9.3 minutes, 70°C for 2 minutes and 80°C and 85°C for 0.09 and 0.02 minutes respectively (FDA Guidelines). As such, it is also recommended to increase clarity of instructions for example labelling "Must be refrigerated below 5°C" and "Cook thoroughly at 70°C for at least 2 min". A through-chain risk management approach starting at primary production will be required to provide safe and suitable product, regardless of the storage instructions, and should also include environmental monitoring of *Listeria*.

Commented [s. 22(1)]: What is considered to be 'extended shelf life'?

Commented [s. 47F(1)]: In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented [s. 47F(1)]: Rather than "used" in my comment I should have said "observed"

Commented [s. 22(1)]: What level is constitutes a public health and safety risks?

Commented [s. 47F(1)]: Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented [s. 47F(1)]: For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 47F(1)]: So would indicate it poses a risk to vul pops, not the general pop, until there was another 10E2 increase?

Commented [s. 47F(1)]: Modified

Commented [s. 22(1)(a)]: I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these mushrooms raw or that they are being eaten this way?

Commented [s. 47F(1)]: Yes, the cited page is still on their website. I have amended the wording so it is as written on the web page

Commented [s. 47F(1)]: Alternative wording: The risk assessment outcomes and the potentially hazardous nature of packaged enoki, indicate that product may not be considered safe and suitable if any of the following is true:

- There are no refrigeration instructions on packages for retail sale or accompanying bulk consignments.
- There are no cooking instructions on packages for retail sale or accompanying bulk consignments.
- There are no date marks on packages for retail sale or accompanying bulk consignments.
- *L. monocytogenes* is detected in at least one of five 25g samples taken from a lot at point of entry at the Australian border, regardless of labelling.
- Product at the Australian border has a remaining shelf-life datemarked >35 days

Commented [s. 47F(1)]: We are not sure of how this would work at the border s. 22(1)(a

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Surveillance information:

Listeriosis is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year). It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness.

Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)

Canada (2021-2023):

- 16 September 2023: Golden Mushroom. Golden Mushroom brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca
- 16th October 2023 Lian Teng. Lian Teng brand "Champignon Énoki" (Enoki Mushrooms) recalled due to Listeria monocytogenes - Canada.ca
- 19th September 2023: Super brand. Super brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca
- 28th July 2023: SSS brand. SSS brand Mushroom (enoki) recalled due to Listeria monocytogenes - Canada.ca
- 15 May 2021: Ravine Mushroom Farms. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
- 7 May 2021: Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca

Australia (2023):

- 28th June 2023: Concordia Traders (Aust) Pty LTD. Current food recalls (foodstandards.gov.au)
- 27th June 2023: Natural Mushroom. Current food recalls (foodstandards.gov.au)
- 7th June 2023: KO Food Australia Pty LTD. Current food recalls (foodstandards.gov.au)
- 2nd June 2023: Fruit Perfection Pty LTD. Current food recalls (foodstandards.gov.au)
- 9th May 2023: Korea Connections. Current food recalls (foodstandards.gov.au)
- 6th April 2023: K-mama https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx
- 10th March 2023: K-mama https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx

US (2022):

- 17th November 2022: Green Day Produce Ltd
- 13th December 2022**:** Utopia Foods

Note: FDA surveillance found many samples of enoki mushrooms were contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains.

Europe (2022):

- 13 May 2022: Ireland,: RASFF notification (2022.2633) Green Box Ltd Cendawan https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html
- 5 May 2022: Slovenia: RASFF notification (2022.2633) Green Box Ltd Cendawan Quantitative sampling detected levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/
- 25th March 2022: Netherlands: RASFF notification (2022.1779) Quantitative sampling detected levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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• 15th February 2022: Netherlands: RASFF notification (2022.1776). Quantitative sampling detected levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. RASFF Window - Notification detail (europa.eu)
Illness associated with consumption of enoki mushrooms contaminated with *Listeria monocytogenes*
A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms.
USA (2016-2022):
• 2022: A recall of Utopia Foods Inc. of Glendale NY, November 2022 and expanded on 13 December 2022. As of 7 April 2023, 5 people infected and hospitalised were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. • 2020: As of 9 June 2020, 36 people were infected by *L. monocytogenes* from 17 states. 31 were hospitalised, 4 died and 2 foetal losses in 6 pregnancy-associated cases. Source identified as enokitake mushrooms supplied by Green Co. LTD. • 2017: *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 ill patients, one died. • 2016: multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 reported illnesses; 4 died.
Australia (2017-2020):
• 6 cases were notified between October 2017 and March 2020. Product was recalled on 10 April 2020. The strains were shown to be related to the USA outbreak strain via whole genome sequencing.
Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms
In 2023, FSANZ coordinated an Australian national survey of imported and domestic enoki. The results indicate that 34/299 (11%) imported enoki samples were contaminated with *L. monocytogenes* at concentrations up to 11,000 CFU/g. The mean contamination level was 1,250 CFU/g. No detections of *L. monocytogenes* were observed in the 36 domestic samples.
Food Standards Agency and Food Standards Scotland issued an advisory notice in 2023 to vulnerable consumers to thoroughly cook enoki mushrooms following sampling data found the presence of *L. monocytogenes* in 13 of 40 (32.5%) samples tested. Contaminated mushrooms were imported from China, Korea, Thailand and other Asian countries. (FSS and the FSA advise on Listeria monocytogenes in imported Enoki mushrooms | Food Standards Scotland)
The US FDA's (2023) national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea and the People's Republic of China, showed 43% and 15% of the samples respectively were positive for *L. monocytogenes*.
A search of scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms; 3 from China and one from Spain. They indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines
Whole fruit and vegetables, including whole fungi, are exempt by definition from *L. monocytogenes* limits for ready-to-eat foods and labelling requirements of the Australia New Zealand Food Standards Code.
In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in enoki mushrooms.
General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020).
Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020).
Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017).

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Standards or guidelines
There are industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). Currently, enoki is held until tests confirm *L. monocytogenes* is not detected in a lot. In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). Currently, to secure release of an individual shipment subject to detention without physical examination under this import alert, the owner, consignee, and/or other responsible party for the affected goods would provide evidence that the product does not bear or contain *L. monocytogenes*. The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

This draft risk statement was compiled in: November 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA Appendix 4- Bacterial pathogen growth and inactivation. https://www.fda.gov/media/80390/download Accessed August 2023.

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition Accessed August 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma . Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Monday, 24 April 2023 5:38 PM
To: Imported Food Program
Subject: Enoki mushrooms [SEC=UNOFFICIAL]
Attachments: Enoki mushrooms.jpg

s. 22(1)(a)(ii) bought some enoki mushrooms today from Coles, grown in Australia. No cooking instructions on the label.

s. 22(1)(a)(ii)

Project Manager | Imported Food
Phone s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @aff.gov.au

Department of Agriculture, Fisheries and Forestry
Residues and Food Branch
Agriculture House, 70 Northbourne Ave, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Monday, 28 November 2022 5:43 PM
To: s. 22(1)(a)(ii) ; s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii) ; s. 22(1)(a)(ii)
Subject: RE: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Thanks s. 22(1)(a)(ii). I can also add that s. 47F(1) (who is currently acting in s. 47F(1) position) phoned me this morning to discuss this issue.

As per s. 22(1)(a)(ii) email below, we are very aware of this issue and discussed in extensively in 2021. It's tricky as enoki mushrooms shouldn't be eaten raw but cooked before consuming. Unfortunately, consumers are misusing the product and adding them to salads etc. Hence, we decided to manage this risk by checking for correct usage instructions on the label. Good one to discuss at the technical meeting. I understand FSANZ will be discussing whether there is a need to consider risks with domestic production but this may have implications for imported product. s. 47F(1) also asked if we should be seeking risk advice. I suggested we discuss at our DAFF/FSANZ meeting next week (8 Dec).

Cheers
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Sent: Monday, 28 November 2022 5:14 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Subject: RE: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

Suggest discussing at the technical meeting on Thursday as the Incident team did some research on enoki mushrooms. We also amended the labelling checklist (G115) to include a note about checking the labelling for cooking instructions. s. 22(1)(a will be able to provide an update and s. 22(1)(a)(ii) would have run data at the time. There's a folder here on this here: \\ACT001FSRVP04\AQISdata$\CD\Compliance Arrangements Branch\IF\Incident Response\Emerging Issues\2021 06 - Enoki and Seafood mushrooms_LM

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Project Manager | Imported Food
Phone s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @agriculture.gov.au

Department of Agriculture, Fisheries and Forestry
Biosecurity Operations Division
18 Marcus Clarke Street, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Sent: Monday, 28 November 2022 10:47 AM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Subject: FW: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Good morning s. 22(1)(a)(ii), s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

Got this enquiry from FSANZ regarding enoki mushrooms. They would like some import data regarding this. Also should we have this on the hort risk advice list.

Hopefully s. 22(1)(a)(ii) will be back soon.

Cheers
s. 22(1)(a)(ii)

From: s. 47F(1) <s. 47F(1) @foodstandards.govt.nz>
Sent: Sunday, 27 November 2022 12:42 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@awe.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Cc: s. 47F(1) <s. 47F(1) @foodstandards.gov.au>
Subject: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii),

I am reaching out to you for some information from DAFF regarding enoki mushrooms. There has been some discussion at recent international meetings and follow on here at FSANZ about the recent outbreaks of Listeria monocytogenes illness associated with consumption of enoki mushrooms. I have attached links to two recent reports:

https://nypost.com/2022/11/22/enoki-mushrooms-linked-to-listeria-outbreak-in-two-states/
https://www.fda.gov/food/cfsan-constituent-updates/fda-issues-country-wide-import-alert-enoki-mushrooms-republic-korea

I was wondering whether or not this is an issue that DAFF is aware of. I note that this is not on the hort list for risk statements, so I was wondering if this is a food product that is imported to Australia and if so, do you know how much is imported annually? Do you think this is something that should be on the hort list for follow-up? If so, would you consider it urgent?

We will be having some internal discussions on this issue over the next week or so, so it would be useful to know whether or not enoki mushrooms are indeed imported and if so how much and from which countries?

I am not aware of any specific outbreaks in Australia of listeriosis from consumption of enoki mushrooms to date. However, a number of other regulators are currently carrying out some preliminary data gathering

activities to assess the risk posed by enoki mushrooms - we think this is something that we should also be also front-footing for Australian public health given the growth in popularity of these types of mushrooms.

I look forward to hearing your thoughts on this.

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1) | m: s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

FOOD STANDARDS Australia • New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Our values: DEVELOP • ACHIEVE • ACCOUNTABLE • RESPECT • TRANSPARENT

We acknowledge the Aboriginal and Torres Strait Islander peoples as First Peoples of Australia and Maori as tangata whenua of Aotearoa New Zealand

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 8 June 2023 8:46 AM
To: Imported Food Program
Subject: FW: New update to Food Recall (FSANZ 2023/42) - KO Foods Enoki Mushrooms - Action and Government Officers [SEC=OFFICIAL]
Attachments: Recall Notice.pdf; Food Recall Information Sheet (2).docx

FYI – the recall includes Asian Grocery Stores in the ACT.

From: Food Recalls <Food.Recalls@foodstandards.gov.au>
Sent: Wednesday, June 7, 2023 7:20 PM
Cc: Food Recalls <Food.Recalls@foodstandards.gov.au>
Subject: New update to Food Recall (FSANZ 2023/42) - KO Foods Enoki Mushrooms - Action and Government Officers [SEC=OFFICIAL]

Document 1

OFFICIAL

Update: recall distribution has been updated to include Asian Grocery Stores in ACT. This updated is reflected in the attached recall notice and information sheet as well as on the FSANZ website.

Dear All

FSANZ FOOD RECALL REFERENCE: FSANZ 2023/42

KO FOOD AUSTRALIA PTY LTD is conducting a Consumer level recall. The details are as follows:

Product Name	Weight	Description	Date Marking		Batch/Barcode number	
Enoki Mushrooms	360g	Retail Packs	Use By	15/7/2023	s. 45(1),s. 47E(d),s. 47	s. 45(1),s. 47E(d),s. 47G(1)(b)

Reason for recall: Incorrect used by date resulting in an increased Listeria monocytogenes risk

State/Territories affected:		Point of sale:
QLD	Yes	Asian Grocery Stores
NSW	Yes	Asian Grocery Stores
ACT	Yes	Asian Grocery Stores
VIC	No	
TAS	No	
NT	No	
SA	Yes	Asian Grocery Stores
WA	No	

Product has been exported: No

Product has been imported: Yes

Country of origin: Korea South

All Action and Government Officers: Please note that distribution lists are not to be provided to anyone outside of government.

ACCC: Please acknowledge this email as official notification to the Minister responsible for Consumer Affairs from KO FOOD AUSTRALIA PTY LTD for the above Consumer level recall. It would be appreciated if you could please pass this notification on to the Ministers for Fair Trading in the affected States and Territories.

Consumer level recalls are published on the FSANZ website.

If you have any questions or concerns, please do not hesitate to contact me.

Kind regards

s. 47F(1)

Food Recall Team

t s. 47F(1) m s. 47F(1) (after-hours recall)

food.recalls@foodstandards.gov.au

www.foodstandards.gov.au
Level 4, 15 Lancaster Place Majura Park, ACT 2609
PO Box 5423, Kingston ACT
2604

The recall mailbox (food.recalls@foodstandards.gov.au) is monitored Monday to Friday during the hours 9am-5pm (Canberra time) and intermittently after hours. If there is a food safety issue or you need to conduct a recall after hours please contact the after hours mobile 0412 166 965.

From: Food Recalls <Food.Recalls@foodstandards.gov.au>
Sent: Wednesday, 7 June 2023 10:37 AM
Cc: Food Recalls <Food.Recalls@foodstandards.gov.au>
Subject: Update to Food Recall (FSANZ 2023/42) - KO Foods Enoki Mushrooms - Action and Government Officers [SEC=OFFICIAL]

OFFICIAL

Recall Update: Manufacturer information provided and update to reason wording

Dear All

FSANZ FOOD RECALL REFERENCE: FSANZ 2023/42

KO FOOD AUSTRALIA PTY LTD is conducting a Consumer level recall. The details are as follows:

Product Name	Weight	Description	Date Marking		Batch/Barcode number	
Enoki Mushrooms	360g	Retail Packs	Use By	15/7/2023	s. 45(1),s. 47E(d),s. 47	s. 45(1),s. 47E(d),s. 47G(1)(b)

Reason for recall: Incorrect use by date resulting in an increased Listeria monocytogenes risk

State/Territories affected:		Point of sale:
QLD	Yes	Asian Grocery Stores
NSW	Yes	Asian Grocery Stores
ACT	No	
VIC	No	
TAS	No	
NT	No	
SA	Yes	Asian Grocery Stores
WA	No	

Product has been exported: No

Product has been imported: Yes

Country of origin: Korea South

All Action and Government Officers: Please note that distribution lists are not to be provided to anyone outside of government.

ACCC: Please acknowledge this email as official notification to the Minister responsible for Consumer Affairs from KO FOOD AUSTRALIA PTY LTD for the above Consumer level recall. It would be appreciated if you could please pass this notification on to the Ministers for Fair Trading in the affected States and Territories.

Consumer level recalls are published on the FSANZ website.

If you have any questions or concerns, please do not hesitate to contact me.

Kind regards

s. 47F(1)

Food Recall Team

t s. 47F(1) m s. 47F(1) (after-hours recall)

food.recalls@foodstandards.gov.au

www.foodstandards.gov.au
Level 4, 15 Lancaster Place Majura Park, ACT 2609
PO Box 5423, Kingston ACT
2604

The recall mailbox (food.recalls@foodstandards.gov.au) is monitored Monday to Friday during the hours 9am-5pm (Canberra time) and intermittently after hours. If there is a food safety issue or you need to conduct a recall after hours please contact the after hours mobile 0412 166 965.

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Food Recall Information Sheet

FSANZ 2023/42
Date: 05/06/2023 04:50 PM

Recall Information	
Reason for Recall	Incorrect **used by** date resulting in an increased Listeria monocytogenes risk
Recall Level	Consumer
Recall Detection	The recall is the result of routine government testing
Corrective Action taken	amended processing/handling procedures (reduced shelf life); changed suppliers; improved communication procedures; Improved manufacturing process (GMP's);
Proposed Method of Disposal/Rectification	Consumers – Return product to place of purchase/importer for a full refund Retailers – Isolate the affected product and destroy under managerial supervision OR for return to/collection by the importer Distribution Centres – Isolate the affected product and destroy under managerial supervision OR for return to/collection by the importer Importer – Isolate the affected product and destroy on site

Product Information		
Food Description	Enoki Mushrooms	
Product Name	Enoki Mushrooms	
Package Details	**Package Description**	**Package Size**
	Retail Packs	360g
Date Marking	Use By	15/7/2023
Batch Identification	**Batch Code**	**GTIN (barcode)**
	ss. 45(1), 47E(d), 47G(1	ss. 45(1), 47E(d), 47G(1)(b)
Country of Origin	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Name	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Details	ss. 45(1), 47E(d), 47G(1)(b)	
Customs entry number	ss. 45(1), 47E(d), 47G(1)(b)	
Manufacturer Name	DR. AG Co., Ltd.	
Manufacturer Details	6, Anguk-gil, Punggak-myeon, Cheongdo-gun, Gyeongsangbuk-do	
Distribution		
Time in Market	2 weeks	
Affected states and territories	**State/Territory**	**Retail Outlets (point of sale)**
	NSW: Yes	Asian Grocery Stores
	ACT: Yes	Asian Grocery Stores
	QLD: Yes	Asian Grocery Stores
	VIC: No	
	TAS: No	
	SA: Yes	Asian Grocery Stores
	NT: No	
	WA: No	

	National: No	

ss. 45(1), 47E(d), 47G(1)(b)

FOOD RECALL

Enoki Mushrooms

360g

Use By 15/7/2023

KO FOOD AUSTRALIA PTY LTD is conducting a recall of the above product. The product has been available for sale at Asian Grocery Stores in NSW, ACT, QLD, SA.

Problem: Incorrect use by date resulting in an increased *Listeria monocytogenes* risk

Food safety hazard: *Listeria monocytogenes* may cause severe illness in pregnant women, unborn babies, neonates, the elderly, and immunocompromised individuals. The general population can also become ill from consuming food contaminated with Listeria monocytogenes.

What to do: Any consumers concerned about their health should seek medical advice and should return the product to the place of purchase for a full refund.

For further information please contact:

KO FOOD AUSTRALIA PTY LTD
0402293310

See www.foodstandards.gov.au/recalls for Australian food recall information

s. 22(1)(a)(ii)

From: Food Recalls <Food.Recalls@foodstandards.gov.au>
Sent: Tuesday, 27 June 2023 12:44 PM
To: 'infosan@nhc.gov.cn'
Cc: Food Recalls; Food Incidents; s. 22(1)(a)(ii) ; Food Recalls; incident; INFOSAN Emergency (Secretariat); s. 22(1)(a)(ii) ; OzFoodNet generic (Health); s. 22(1)(a)(ii) ; s. 22(1)(a)(ii)
Subject: Food Recall (FSANZ 2023/49) - Natural Mushrooms - Enoki Mushrooms - INFOSAN Notification [SEC=OFFICIAL]

OFFICIAL

Dear INFOSAN Emergency Contact Point China

Food Standards Australia New Zealand (Australian INFOSAN Emergency Contact Point) has initiated direct notification to INFOSAN Emergency Contact Points of all food recalls when the affected product either originated from another country or was exported from Australia. As such your INFOSAN Emergency Contact point will be notified of:
• a food recall in Australia when the product has been imported from/manufactured in your country
• any recall of a food product manufactured in Australia that was exported to your country (where known)

This email is notifying you of a Consumer level recall in Australia of:
• Enoki Mushrooms 360g (+-20g) recalled for the recall is due to an incorrect use by date resulting in an increased Listeria monocytogenes risk

The recall was initiated by the Australian importer.

s. 45(1),s. 47E(d),s. 47G(1)(b)

Details of the food recall, including product image and batch information, is posted on the FSANZ website.

Kind regards,
s. 47F(1)

National Food Incident Response Team (INFOSAN Emergency Contact Point)
Food Safety and Response Section

t s. 47F(1) | m s. 47F(1) (after-hours only)
incident@foodstandards.gov.au
www.foodstandards.gov.au

Level 4, 15 Lancaster Place Majura Park, ACT 2609
PO Box 5423, Kingston ACT 2604

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 8 June 2023 1:03 PM
To: s. 22(1)(a)(ii) ; s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii); s. 22(1)(a)(ii)
Subject: RE: FOR REVIEW: Imported food incident response form - holding order for enoki mushrooms [SEC=OFFICIAL]

Approved to proceed with applying HOs as described in the form.

s. 22(1)(a)(ii)

Project Manager | Imported Food
Phone s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @aff.gov.au

Department of Agriculture, Fisheries and Forestry
Residues and Food Branch
Agriculture House, 70 Northbourne Ave, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, June 8, 2023 12:59 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>
Subject: FOR REVIEW: Imported food incident response form - holding order for enoki mushrooms [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii) and s. 22(1)(a)(ii),

For review, the Imported food incident response form to apply a holding order for enoki mushrooms.

The holding orders are a result of two recalls by Fruit Perfection and KO Foods Australia.

I have created a shell task in Teams and have included both of you so that it can be reviewed either this week or next week.

If you have any questions, please let me know.

Kind regards,

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

A/g Assistant Director| Incident Response and Stakeholder Engagement|Imported Food
Residues and Food Branch | Exports and Veterinary Services Division
Department of Agriculture, Fisheries and Forestry
T: s. 22(1)(a)(ii) |M: s. 22(1)(a)(ii) |E: s. 22(1)(a)(ii) @aff.gov.au

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Food Recall Information Sheet

FSANZ 2023/13
Date: 08/03/2023 04:29 PM

Recall Information	
Reason for Recall	microbial - contaminated by the bacterium Listeria monocytogenes
Recall Level	Consumer
Recall Detection	The recall is the result of routine government testing
Corrective Action taken	altered product label, improved communication procedures and training of staff;
Proposed Method of Disposal/Rectification	Consumers – Return product to place of purchase for a full refund Retailers – Isolate the affected product and destroy under managerial supervision OR for collection by the importer Distribution Centres – Isolate the affected product and destroy under managerial supervision OR for collection by the importer Importer – Isolate the affected product and destroy on site

Product Information		
Food Description	Enoki Mushroom	
Product Name	K-mama Enoki Mushrooms (300g)	
Package Details	**Package Description**	**Package Size**
	Individually packed in vinyl wrapping; sold in a cardboard box of 17	300g
Date Marking	Best Before	03.06.2023
Batch Identification	**Batch Code**	**GTIN (barcode)**
	ss. 45(1), 47E(d), 47G(1)(b)	
Country of Origin	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Name	ss. 45(1), 47E(d), 47G(1)(b)	
Customs entry number	ss. 45(1), 47E(d), 47G(1)(b)	
Distribution		
Units Imported/Manufactured	Precise Quantity: 591 ctns (10047 individual packs)	
Units Warehoused	Precise Quantity: 0	
Time in Market	2 weeks	
Affected states and territories	**State/Territory**	**Retail Outlets (point of sale)**
	QLD: Yes	Independent food retailers and Asian Grocery Stores
	NSW: Yes	An Asian Grocery store in Lismore

ss. 45(1), 47E(d), 47G(1)(b)

s. 22(1)(a)(ii)

From: Food Recalls <Food.Recalls@foodstandards.gov.au>
Sent: Thursday, 6 April 2023 8:44 PM
Cc: Food Recalls
Subject: Food Recall (FSANZ 2023/23) - Y & J Customs Enoki Mushrooms - Action and Government Officers [SEC=OFFICIAL]
Attachments: K-mama Enoki Mushrooms 300g Recall Notice.pdf; Food Recall Information Sheet.docx

OFFICIAL

Dear All

FSANZ FOOD RECALL REFERENCE: FSANZ 2023/23

Y & J Connect Pty Ltd is conducting a Consumer level recall. The details are as follows:

Product Name	Weight	Description	Date Marking	
K-mama Enoki Mushrooms 300g	300g	Individually packed in vinyl wrapping; sold in a cardboard box	Best Before	13.07.2023

Reason for recall: contaminated by the bacterium *Listeria monocytogenes*

State/Territories affected:		Point of sale:
QLD	Yes	Hanaro Marts: 22 branches
NSW	Yes	Hanaro Marts: 1 branch

Product has been exported: No

Product has been imported: Yes

Country of origin: Republic of Korea

All Action and Government Officers: Please note that distribution lists are not to be provided to anyone outside of government.

ACCC: Please acknowledge this email as official notification to the Minister responsible for Consumer Affairs from Y & J Connect Pty Ltd for the above Consumer level recall. It would be appreciated if you could please pass this notification on to the Ministers for Fair Trading in the affected States and Territories.

Consumer level recalls are published on the FSANZ website.

If you have any questions or concerns, please do not hesitate to contact me.

Kind regards

s. 47F(1)

Food Recall Team

t s. 47F(1) m s. 47F(1) (after-hours recall)

food.recalls@foodstandards.gov.au

www.foodstandards.gov.au
Level 4, 15 Lancaster Place Majura Park, ACT 2609
PO Box 5423, Kingston ACT
2604

The recall mailbox (food.recalls@foodstandards.gov.au) is monitored Monday to Friday during the hours 9am-5pm (Canberra time) and intermittently after hours. If there is a food safety issue or you need to conduct a recall after hours please contact the after hours mobile 0412 166 965.

FOOD RECALL

K-mama Enoki Mushrooms 300g
Best Before 13.07.2023

Y & J Connect Pty Ltd is conducting a recall of the above product. The product has been available for sale at Hanaro Marts in QLD and NSW.

Problem: The recall is due to contaminated by the bacterium *Listeria monocytogenes*

Food safety hazard: *Listeria monocytogenes* may cause severe illness in pregnant women, unborn babies, neonates, the elderly, and individuals who are immunocompromised. The general population can also become ill from consuming food contaminated with *Listeria monocytogenes.*

What to do: Consumers should not eat this product. Any consumers concerned about their health should seek medical advice. and should return the product to the place of purchase for a full refund.

For further information please contact:

Y & J Connect Pty Ltd
61-7-3274-1700

See www.foodstandards.gov.au/recalls for Australian food recall information

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Food Recall Information Sheet

FSANZ 2023/23
Date: 06/04/2023 04:28 PM

Recall Information	
Reason for Recall	contaminated by the bacterium Listeria monocytogenes Microbial (Listeria monocytogenes)
Recall Level	Consumer
Recall Detection	The recall is the result of routine government testing
Pathogen	
Corrective Action taken	altered product label; improved communication procedures; training of staff;
Proposed Method of Disposal/Rectification	Consumers – Return product to place of purchase for a full refund Retailers – Isolate the affected product and destroy under managerial supervision Distribution Centres – Isolate the affected product and destroy under managerial supervision for collection by the importer Importer – Isolate the affected product and destroy on site

Product Information		
Food Description	Enoki Mushrooms	
Product Name	K-mama Enoki Mushrooms 300g	
Package Details	**Package Description**	**Package Size**
	Individually packed in vinyl wrapping; sold in a cardboard box	300g
Date Marking	Best Before	13.07.2023
Country of Origin	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Name	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Details	ss. 45(1), 47E(d), 47G(1)(b)	
Customs entry number	ss. 45(1), 47E(d), 47G(1)(b)	
Distribution		
Units Imported/Manufactured	Precise Quantity 9860	
Units Warehoused	Unknown	
Time in Market	4 Weeks	
Affected states and territories	**State/Territory**	**Retail Outlets (point of sale)**
	NSW: Yes	Hanaro Marts: 1 branch
	ACT: No	
	QLD: Yes	Hanaro Marts: 22 branches
	VIC: No	
	TAS: No	
	SA: No	
	NT: No	
	WA: No	

	National: No	

ss. 45(1), 47E(d), 47G(1)(b)

Communication Plan	
Communicated to Consumers via	Social media and website
Company Website	
Public Contact Number	61-7-3274-1700
Consumers seeking information on the recall may be directed to the FSANZ website.	

s. 22(1)(a)(ii)

From: Food Recalls <Food.Recalls@foodstandards.gov.au>
Sent: Tuesday, 9 May 2023 2:01 PM
Cc: Food Recalls
Subject: Food Recall (FSANZ 2023/29) - KOREA CONNECTIONS PTY LTD - Action and Government Officers [SEC=OFFICIAL]
Attachments: Food Recall Information Sheet.docx; Food Recall Press Advertisement_Enoki Mushroom.pdf

OFFICIAL

Dear All

FSANZ FOOD RECALL REFERENCE: FSANZ 2023/29

KOREA CONNECTIONS PTY LTD is conducting a Consumer level recall. The details are as follows:

Product Name	Weight	Description	Date Marking		Batch/Barcode number
ENOKI MUSHROOM 300G	300g	Plastic packaging bag	Best Before	BEST BEFORE: AUG. 17 2023	AUG. 17 2023

Reason for recall: microbial (Listeria Contamination)

State/Territories affected:		Point of sale:
QLD	No	
NSW	No	
ACT	No	
VIC	No	
TAS	No	
NT	No	
SA	No	
WA	Yes	Asian Grocery Stores

Product has been exported: No

Product has been imported: Yes

Country of origin: Korea South

All Action and Government Officers: Please note that distribution lists are not to be provided to anyone outside of government.

ACCC: Please acknowledge this email as official notification to the Minister responsible for Consumer Affairs from KOREA CONNECTIONS PTY LTD for the above Consumer level recall. It would be appreciated if you could please pass this notification on to the Ministers for Fair Trading in the affected States and Territories.

Consumer level recalls are published on the FSANZ website.

If you have any questions or concerns, please do not hesitate to contact me.

Kind regards

s. 47F(1)

Food Recall Team

t s. 47F(1) m s. 47F(1) (after-hours recall)

food.recalls@foodstandards.gov.au

www.foodstandards.gov.au
Level 4, 15 Lancaster Place Majura Park, ACT 2609
PO Box 5423, Kingston ACT
2604

The recall mailbox (food.recalls@foodstandards.gov.au) is monitored Monday to Friday during the hours 9am-5pm (Canberra time) and intermittently after hours. If there is a food safety issue or you need to conduct a recall after hours please contact the after hours mobile 0412 166 965.

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Food Recall Information Sheet

FSANZ 2023/29
Date: 08/05/2023 07:59 PM

Recall Information	
Reason for Recall	The recall is due to the contamination of Listeria monocytogenes and the absence of instructions to cook the product prior to consumption.
Recall Level	Consumer
Recall Detection	The recall is the result of routine government testing
Pathogen	Listeria monocytogenes
Corrective Action taken	altered product label;
Proposed Method of Disposal/Rectification	Consumers – Return product to place of purchase for a full refund Retailers – Isolate the affected product and destroy under managerial supervision OR for return to by the importer Distribution Centres – Isolate the affected product and destroy under managerial supervision OR for return to by the importer Importer – Isolate the affected product and destroy on site

Product Information		
Food Description	MUSHROOMS	
Product Name	ENOKI MUSHROOM 300G	
Package Details	**Package Description**	**Package Size**
	Plastic packaging bag	300g
Date Marking	Best Before	BEST BEFORE: AUG. 17, 2023
Batch Identification	**Batch Code**	**GTIN (barcode)**
	ss. 45(1), 47E(d), 47G(1)(b)	
Manufactured In		
Country of Origin	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Name	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Details	ss. 45(1), 47E(d), 47G(1)(b)	
Distribution		
Time in Market	2 weeks	
Affected states and territories	**State/Territory**	**Retail Outlets (point of sale)**
	WA: Yes	Asian Grocery Stores

ss. 45(1), 47E(d), 47G(1)(b)

ss. 45(1), 47E(d), 47G(1)(b)

Communication Plan	
Communicated to Consumers via	point of sales notification
Public Contact Number	0425 898 639
Consumers seeking information on the recall may be directed to the FSANZ website.	

FOOD RECALL

ENOKI MUSHROOMS 300G
Best Before 17.08.2023

Korea connections is conducting a notice of the above product. The products have been available for sale at independent/Asian grocery stores in WA.

Problem: The recall is due to the contamination of Listeria monocytogenes and no instructions to cook the product prior to consumption.

Food Safety Hazard: Listeria monocytogenes may cause severe illness in pregnant women, unborn babies, neonates, the elderly, and individuals who are immunocompromised. The general population can also become ill from consuming food contaminated with Listeria monocytogenes.

What to do: Consumers should not eat this product. Any consumers concerned about their health should seek medical advice and should return the product to the place of purchase for a full refund.

For further information contact:

Korea Connections (WA)
Ph: 0433 888 639

See www.foodstandards.gov.au/recalls for Australian food recall information

Australian Government
Department of Agriculture, Water and the Environment

Imported food incident response form

(IFP-FM419)

Section A: Action required

☒ Holding order (H/O) - Reasonable grounds (Section 15(1)(b) of *Imported Food Control Act 1992* (the Act))

☐ H/O – Extension of emergency (Section 15(4) of the Act)

Previous extension: mm/dd/yyyy to mm/dd/yyyy
Number of extensions:
Date extended to:

☐ H/O - Emergency (Section 15(3) of the Act)

☐ Increasing the rate that risk food is inspected.

Section 18(4) of the Imported Food Control Regulations 2019 provides that the rates may be raised when:

a) one or more batches of the food fail inspection

or

b) an authorised officer believes that the food does not comply with the applicable standards or poses a risk to human health.

(Note: no H/O classification or number is required)

Section B: Reason for response

Include details of the food, notifying organisation (if applicable), if the food has been subject to recall in Australia or internationally and reason, reported illnesses, test(s) to apply and if the producer and product is identifiable in AIMs and/ or the ICS.

On 9 May 2023, a consumer recall was conducted on enoki mushrooms imported from Korea - Korea Connections Enoki Mushrooms (foodstandards.gov.au), due to contamination with *Listeria monocytogenes* and the absence of instructions to cook the product prior to consumption.

The enoki mushrooms were imported by Shin Mi Australia Pty Ltd. Korea Connections purchased the enoki mushrooms from Shin Mi (Australia) Pty. Limited.

HO applied to verify products are labelled with cooking instructions, as required under FSC Standard 1.2.6 - 2(b).

Section C: Holding order classification in AIMS

☒ Food recall (REC)

☐ Incident (INC)

☐ Temporary holding order (THO)

☐ Other – provide details

Details	FSANZ recall number 2023/29

Section D: Imported food details

Brand name	Unknown
Country of origin	Republic of Korea
Customs entry number (if known)	Not applicable
Goods description	Enoki mushrooms (fresh)
Importer code	78001582887
Importer name	SHIN MI (AUSTRALIA) PTY. LIMITED
Producer code/s (if multiple note all)	00308247
Producer name	HAMPYEONGCHONJI MUSHROOM AGRICUOTURAL UNION CORPORATION
Tariff code (include all 10 digits)	07095900 90
Test (if applicable)*	Labelling
Additional details*	HO applied to verify products are labelled with cooking instructions, as required under FSC Standard 1.2.6 - 2(b).

* For further information on completing fields, refer to Work Instruction: *Responding to food incidents involving imported food (IFP-W1411*).

Section E: Holding order number

Holding order number: REC23001 Date: May 2023

Section F: Declaration

Delegate declaration	**Date**
s. 22(1)(a)(ii)	15/05/2023

Delegate of the Secretary appointed under Section 41 of the Act for the purposes of Sections 15 and 16 of the Act.

s. 22(1)(a)(ii)

From: Food Recalls <Food.Recalls@foodstandards.gov.au>
Sent: Tuesday, 27 June 2023 12:33 PM
Cc: Food Recalls
Subject: Food Recall (FSANZ 2023/49) - Natural Mushrooms - Enoki Mushrooms - Action and Government Officers [SEC=OFFICIAL]
Attachments: Recall Notice Natural Mushrooms.pdf; Food Recall Information Sheet.docx

Follow Up Flag: Follow up
Flag Status: Flagged

OFFICIAL

Dear All

FSANZ FOOD RECALL REFERENCE: FSANZ 2023/49

Natural Mushroom Supplier is conducting a Consumer level recall. The details are as follows:

Product Name	Weight	Description	Date Marking		Batch/Barcode number
Enoki Mushrooms	360g (+-20g)	Plastic bags	Use By	13/07/2023	s. 45(1),s. 47E(d),s. 47G(1)(b)

Reason for recall: The recall is due to an incorrect use by date resulting in an increased Listeria monocytogenes risk

State/Territories affected:		Point of sale:
QLD	No	
NSW	No	
ACT	No	
VIC	Yes	Asian Grocery Stores
TAS	No	
NT	No	
SA	No	
WA	No	

Product has been exported: No

Product has been imported: Yes

Country of origin: China

All Action and Government Officers: Please note that distribution lists are not to be provided to anyone outside of government.

ACCC: Please acknowledge this email as official notification to the Minister responsible for Consumer Affairs from Natural Mushroom Supplier for the above Consumer level recall. It would be appreciated if you could please pass this notification on to the Ministers for Fair Trading in the affected States and Territories.

Consumer level recalls are published on the FSANZ website.

If you have any questions or concerns, please do not hesitate to contact me.

Kind regards

s. 47F(1)

Food Recall Team

t s. 47F(1) m s. 47F(1) (after-hours recall)

food.recalls@foodstandards.gov.au

www.foodstandards.gov.au
Level 4, 15 Lancaster Place Majura Park, ACT 2609
PO Box 5423, Kingston ACT
2604

The recall mailbox (food.recalls@foodstandards.gov.au) is monitored Monday to Friday during the hours 9am-5pm (Canberra time) and intermittently after hours. If there is a food safety issue or you need to conduct a recall after hours please contact the after hours mobile 0412 166 965.

FOOD RECALL

Enoki Mushrooms
360g (+-20g)
Use By 13/07/2023

Natural Mushroom Supplier is conducting a recall of the above product. The product has been available for sale at Asian Grocery Stores in VIC.

Problem: The recall is due to an incorrect use by date resulting in an increased *Listeria monocytogenes* risk

Food safety hazard: *Listeria monocytogenes* may cause severe illness in pregnant women, unborn babies, neonates, the elderly, and immunocompromised individuals. The general population can also become ill from consuming food contaminated with *Listeria monocytogenes.*

What to do: Any consumers concerned about their health should seek medical advice and should return the product to the place of purchase for a full refund.

For further information please contact:

Natural Mushroom Supplier
0410518208
naturalmushroom@outlook.com

See www.foodstandards.gov.au/recalls for Australian food recall information

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Food Recall Information Sheet

FSANZ 2023/49
Date: 26/06/2023 07:16 PM

Recall Information	
Reason for Recall	The recall is due to an incorrect use by date resulting in an increased Listeria monocytogenes risk
Recall Level	Consumer
Recall Detection	The recall is the result of routine government testing
Pathogen	Listeria monocytogenes
Corrective Action taken	other; Contacted the supplier on 26/06/2023 evening, informed event and the risks of contamination of Listeria monocytogenes. The supplier informed that they are always and very aware of this matter, they need some time to investigate, and require the manufacturer to inspect and improve the related cultivation process.
Proposed Method of Disposal/Rectification	Consumers – Return product to importer for a full refund Retailers – Isolate the affected product and destroy under managerial supervision OR for return to the importer Distribution Centres – Isolate the affected product and destroy under managerial supervision OR for return to the importer Manufacturer/Importer – Isolate the affected product and destroy on site

Product Information		
Food Description	Enoki Mushrooms	
Product Name	Enoki Mushrooms	
Package Details	**Package Description**	**Package Size**
	Plastic bags	360g (+-20g)
Date Marking	Use By	13/07/2023
Batch Identification	**Batch Code**	**GTIN (barcode)**
		ss. 45(1), 47E(d), 47G(1)(b)
Country of Origin	ss. 45(1), 47E(d),	
Importer Name	ss. 45(1), 47E(d), 47G(1)(b)	
Importer Details	ss. 45(1), 47E(d), 47G(1)(b)	
Customs entry number	AEXXNCA6N	
Manufacturer Name	ss. 45(1), 47E(d), 47G(1)(b)	
Manufacturer Details	ss. 45(1), 47E(d), 47G(1)(b)	
Distribution		
Units Imported/Manufactured	Approximate Quantity 500 ctns	
Time in Market	3 Days to a week	
	State/Territory	**Retail Outlets (point of sale)**

Affected states and territories	NSW:	No	
	ACT:	No	
	QLD:	No	
	VIC:	Yes	Asian Grocery Stores
	TAS:	No	
	SA:	No	
	NT:	No	
	WA:	No	
	National:	No	

ss. 45(1), 47E(d), 47G(1)(b), 47F(1)

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 1 December 2022 2:58 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: FYI: Data on enoki mushroom [SEC=OFFICIAL]

Hi RMIE team

Re – enoki mushroom

As requested at the technical meeting today, I have searched for data on national and international recalls of enoki mushrooms.

Horizonscan data – search was for all data on enoki mushrooms.
IRSE data – search for all data on enoki, noting our data only goes back to beginning of 2019. Also note, this information is sensitive and for our use only (not to be shared with external organisations). The broad data should align with Horizonscan data.
Data search using AIMS data from Hyperion – 01/01/19 to 01/12/2022 for fresh enoki mushroom ~ **7,395,998 kg**
Imported from: Republic of Korea and China

s. 22(1)(a)(ii)

s. 22(1)(a)(ii),s. 47F(1)

Let me know if you need any further information.

Regards

s. 22(1)(a

s. 22(1)(a)(ii)
Technical Manager | Incident Response and Stakeholder Engagement | Imported Food | Biosecurity Operations Division

Phone: s. 22(1)(a)(ii) | Email: s. 22(1)(a)(ii)@agriculture.gov.au

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Monday, 12 December 2022 1:21 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

FSANZ requested a formal letter if we want to proceed with risk advice for enoki mushrooms.

We can discuss this more at our catch up in 10 minutes, but I drafted a letter in the meantime.

draft letter

Regards s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Sent: Tuesday, 29 November 2022 8:57 AM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Subject: RE: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Thanks s. 22(1)(a)(ii).

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Sent: Tuesday, 29 November 2022 8:54 AM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Subject: RE: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Good morning all,
Yes I have popped this issue in the IF meeting agenda for this week for discussion. I have spoken to s. 22(1)(a)(ii) about it as well.

I have also made a note to discuss with FSANZ at the interagency meeting on 8 Dec.

Cheers
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Sent: Monday, 28 November 2022 5:43 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Subject: RE: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Thanks s. 22(1)(a)(ii). I can also add that s. 47F(1) (who is currently acting in s. 47F(1) position) phoned me this morning to discuss this issue.

As per s. 22(1)(a)(ii) email below, we are very aware of this issue and discussed in extensively in 2021. It's tricky as enoki mushrooms shouldn't be eaten raw but cooked before consuming. Unfortunately, consumers are misusing the product and adding them to salads etc. Hence, we decided to manage this risk by checking for correct usage instructions on the label. Good one to discuss at the technical meeting. I understand FSANZ will be discussing whether there is a need to consider risks with domestic production but this may have implications for imported product. s. 47F(1) also asked if we should be seeking risk advice. I suggested we discuss at our DAFF/FSANZ meeting next week (8 Dec).

Cheers
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Sent: Monday, 28 November 2022 5:14 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Subject: RE: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

Suggest discussing at the technical meeting on Thursday as the Incident team did some research on enoki mushrooms. We also amended the labelling checklist (G115) to include a note about checking the labelling for cooking instructions. s. 22(1)(a will be able to provide an update and s. 22(1)(a)(ii) would have run data at the time. There's a folder here on this here: \\ACT001FSRVP04\AQISdata$\CD\Compliance Arrangements Branch\IF\Incident Response\Emerging Issues\2021 06 - Enoki and Seafood mushrooms_LM

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Project Manager | Imported Food
Phone s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @agriculture.gov.au

Department of Agriculture, Fisheries and Forestry
Biosecurity Operations Division
18 Marcus Clarke Street, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>
Sent: Monday, 28 November 2022 10:47 AM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@agriculture.gov.au>

Cc: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Subject: FW: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Good morning s. 22(1)(a)(ii), s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

Got this enquiry from FSANZ regarding enoki mushrooms. They would like some import data regarding this. Also should we have this on the hort risk advice list.

Hopefully s. 22(1)(a)(ii) will be back soon.

Cheers
s. 22(1)(a)(ii)

From: s. 47F(1) <s. 47F(1) @foodstandards.govt.nz>
Sent: Sunday, 27 November 2022 12:42 PM
To: s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@awe.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @agriculture.gov.au>
Cc: s. 47F(1) <s. 47F(1) @foodstandards.gov.au>
Subject: Listeria monocytogenes and enoki mushrooms [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii),

I am reaching out to you for some information from DAFF regarding enoki mushrooms. There has been some discussion at recent international meetings and follow on here at FSANZ about the recent outbreaks of Listeria monocytogenes illness associated with consumption of enoki mushrooms. I have attached links to two recent reports:

https://nypost.com/2022/11/22/enoki-mushrooms-linked-to-listeria-outbreak-in-two-states/
https://www.fda.gov/food/cfsan-constituent-updates/fda-issues-country-wide-import-alert-enoki-mushrooms-republic-korea

I was wondering whether or not this is an issue that DAFF is aware of. I note that this is not on the hort list for risk statements, so I was wondering if this is a food product that is imported to Australia and if so, do you know how much is imported annually? Do you think this is something that should be on the hort list for follow-up? If so, would you consider it urgent?

We will be having some internal discussions on this issue over the next week or so, so it would be useful to know whether or not enoki mushrooms are indeed imported and if so how much and from which countries?

I am not aware of any specific outbreaks in Australia of listeriosis from consumption of enoki mushrooms to date. However, a number of other regulators are currently carrying out some preliminary data gathering activities to assess the risk posed by enoki mushrooms - we think this is something that we should also be also front-footing for Australian public health given the growth in popularity of these types of mushrooms.

I look forward to hearing your thoughts on this.

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1) | m: s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

FOOD STANDARDS Australia • New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Our values: DEVELOP • ACHIEVE • ACCOUNTABLE • RESPECT • TRANSPARENT

We acknowledge the Aboriginal and Torres Strait Islander peoples as First Peoples of Australia and Maori as tangata whenua of Aotearoa New Zealand

Australian Government
Department of Agriculture, Fisheries and Forestry

Ms Christel Leemhuis
General Manager, Science and Risk Assessment Branch
Food Standards Australia New Zealand
PO Box 5423
KINGSTON ACT 2604

Dear Ms Leemhuis

I am writing to you to request advice on the risks associated with enoki mushrooms for human consumption. This request is per section 6.1.1(a) (iii) of Schedule 2 (An arrangement for coordination of procedures and communication of imported food issues) to the Memorandum of Understanding between the Department of Agriculture, Fisheries and Forestry and the Department of Health and Aged Care.

Following ~~discussions at international meetings and~~ recent ~~foodborne illness outbreaks of~~cases of *Listeria monocytogenes* illness being ~~overseas~~ associated with the consumption of uncooked enoki mushrooms both overseas and in Australia, the department wants to ensure ~~that they have~~ adequate measures are in place to manage the food safety risks associated with imported enoki mushrooms for human consumption. This advice is separate to the advice currently being provided to the department on high risk horticulture as this advice is specific to ready-to-eat fruits and vegetables. As per the department's previous investigation and response to illness associated with imported enoki mushrooms, these mushrooms are not intended to be eaten without cooking.

In 2019, both the United States of America~~S~~ (USA) and Canada linked historical and recent cases of listeriosis with consumption of enoki mushrooms from the Republic of Korea. This link was made through whole genome sequencing. Both countries have undertaken~~ook~~ recalls, as a result of thise link ~~, being made with the mushrooms.~~ In the USA between 2016 and 2019, 36 cases of listeriosis were identified ~~(between 2016-2019) and~~resulting in 4 deaths. In Canada between 2017 and 2019, 6 cases of listeriosis were identified ~~(between 2017-2019).~~

The department confirmed, via the International Food Safety Network (INFOSAN) Emergency Contact points in the USA and Canada, that the supplier/producer of e~~E~~noki mushroom in the Republic of Korea, implicated in the USA outbreak, also supplied enoki mushroom to the Australian market.

As a result of these recalls and confirmation of Australia's imports of the implicated enoki mushrooms, OzFoodNet investigated whether any cases in Australia were potentially linked. Six cases were identified as being related to the US outbreak through whole genome sequencing, including one death. ~~The date range for these illnesses were from October 2017 to March 2020.~~

~~A case who became ill in January 2019 passed away in February of the same year. The person was a 77yr old immunocompromised male in Qld who was a regular consumer of mushrooms and enoki mushrooms from the Republic of Korea, sold at the supermarket he frequented. Samples of Green Co. enoki mushrooms from this supermarket were taken for testing by Qld the local jurisdiction health and results came back positive for *Listeria monocytogenes*.~~

Commented [s. 22(1)]: Have deleted as not personally aware of any discussions at international meetings and if this is included supporting text will need to be added to letter.

Commented [s. 22(1)]: Do I need to add links?

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Commented [s. 22(1)]: Don't need this level of detail in letter.

T +61 2 6272 3933
F +61 2 6272 5161

70 Northbourne Ave
Canberra ACT 2600

GPO Box 858
Canberra ACT 2601

agriculture.gov.au
ABN 34 190 894 983

The importer of Green Co. enoki mushrooms, Choi's Mushrooms in NSW, recalled this product. Consumers were advised by Food Standards Australia New Zealand to cook enoki mushrooms before consumption.

The department applied holding orders on the supplier/producer of enoki mushrooms from the Republic of Korea, Green Co. to ensure future consignments of enoki were referred to the Imported Food Inspection Scheme for inspection, including checking the label to ensure cooking instructions were clearly stated.

~~We requested information from the Republic of Korea, via the INFOSAN secretariat, on the type and scope of sanitary measures being implemented by companies that export enoki mushrooms; what cooking instructions would be provided on the enoki packaging, and that instructions will be declared in English.~~

Following increased testing of enoki mushrooms traded internationally, multiple recalls have been conducted. Recent data on international recalls of enoki mushrooms for *Listeria monocytogenes* contamination can be viewed ~~in~~at Attachment 1.

As this advice will be used to inform possible changes to the monitoring of enoki mushrooms under the *Imported Food Control Act 1992*, we would be grateful if it could be finalised by xxx. If the department can provide additional information to assist FSANZ with this request, please contact Ms s. 22(1)(a)(ii) via email at s. 22(1)(a)(ii) @aff.gov.au.

Yours sincerely

Ms Vikki Fischer
Assistant Secretary
Pathway Policy – Travellers, Mail and Imported Food
Department of Agriculture, Fisheries and Forestry

xx December 2022

Commented [s. 22(1)]: Suggest deleting to reduce length of letter and detail.

Commented [s. 22(1)]: Date?

Commented [RJ6]: s. 22(1)(a)(ii) or Vikki?

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Australian Government
Department of Agriculture, Fisheries and Forestry

Ms Christel Leemhuis
General Manager, Science and Risk Assessment Branch
Food Standards Australia New Zealand
PO Box 5423
KINGSTON ACT 2604

Dear Ms Leemhuis

Thank you for your letter of 5 January 2023.

I note that FSANZ will prepare risk advice on *Listeria monocytogenes (L. monocytogenes)* in enoki mushrooms as soon as possible. I further appreciate FSANZ liaising with the jurisdictions to consider investigating testing of product at retail to capture domestically produced enoki mushrooms.

In response to your request to consider capturing imported enoki mushrooms for border surveillance testing for *L. monocytogenes* while you complete the risk advice. We will consider your request to capture imported enoki mushrooms for surveillance testing for *L. monocytogenes.*

We thank you for your work on enoki mushrooms and appreciate FSANZs engagement throughout the process.

Yours sincerely

Ms Vikki Fischer
Assistant Secretary
Pathway Policy – Travellers, Mail and Imported Food
Department of Agriculture, Fisheries and Forestry

xx January 2023

T +61 2 6272 3933
F +61 2 6272 5161

70 Northbourne Ave
Canberra ACT 2600

GPO Box 858
Canberra ACT 2601

agriculture.gov.au
ABN 34 190 894 983

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Saturday, 22 April 2023 11:16 AM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: Imported mushrooms [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Thanks for the information on imported mushrooms, that is exactly what I was after.

Just as an FYI, I completed the enoki mushroom and Listeria risk statement last week and it is currently going through internal review. I will send it through as soon as I have received their comments for your consideration.

Regards

s. 47F(1)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 20 April 2023 5:13 PM
To: s. 47F(1) @foodstandards.govt.nz>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: Imported mushrooms [SEC=OFFICIAL]

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Good afternoon s. 47F(1)

Please see import volumes for mushrooms since 1 January 2022 to date below.

Hope this is what you were looking for.

Cheers

s. 22(1)(a)(ii)

Tariff code	Description	Quantity (kg)
07095900	Other mushrooms, fresh or chilled	5,845,647.20
20031000	Mushrooms of the genus *Agaricus* (prepared or preserved otherwise than by vinegar or acetic acid)	4,289,857.61
20039090	Other mushrooms, prepared or preserved	1,151,369.97
07095400	Shiitake (*Lentinus edodes*) – fresh or chilled	149,678.40
07095100	Mushrooms of the genus *Agaricus* – fresh or chilled	32,038.50
07095200	Mushrooms of the genus *Boletus* – fresh or chilled	12,309.75
07095500	Matsutake (*Tricholoma matsutake, Tricholoma magnivelare, Tricholoma anatolicum, Tricholoma dulciolens, Tricholoma caligatum*) – fresh or chilled	0.22

Grand total		**11,480,901.65**

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Tuesday, 18 April 2023 8:56 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Subject: Imported mushrooms [SEC=OFFICIAL]

OFFICIAL

s. 22(1)(a)(ii)

Hi

A question was raised at our micro section meeting yesterday regarding risks associated with consumption of other types of exotic mushrooms. In the main these would generally be cooked but it did raise the question of what other types of mushrooms are imported into Australia in significant quantity. I assume that the standard button mushrooms and portabella style would be domestically produced and not imported (but might be wrong!).

So can you tell me what other types of mushrooms are imported to Australia and how much of each would be imported annually (say for 2022).

Thanks

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: +s. 47F(1) m: s. 47F(1)
e: s. 47F(1) foodstandards.govt.nz

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****

intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error please notify the system manager.
Scanned by Office 365 Email Gateway at Food Standards ANZ.
****

s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 5 January 2023 8:35 AM
To: s. 22(1)(a)(ii)
Cc: s. 47F(1)
Subject: RE: FDA recall enoki [SEC=OFFICIAL]
Attachments: 2023 01 04 - enoki mushroom - Leemhuis to Fischer.docx

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached a letter from Christel Leemhuis in reply to Ms Fischer's letter dated 22 December 2022 requesting risk advice for imported enoki mushrooms.

As noted in the response we will start preparing the requested risk advice as soon as possible.

If you have any questions or concerns about this work, please do not hesitate to get in touch and we can arrange a suitable meeting time to discuss.

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1) m: s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 22 December 2022 2:42 pm
To: s. 47F(1) @foodstandards.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Hello s. 47F(1)

Please find attached a letter from Vikki Fischer to Christel Leemhuis requesting formal risk advice for enoki mushrooms.

s. 22(1)(a)(ii) requested not for anything to be published until we had a look at the draft risk advise for enoki mushrooms.

Vikki asked that I pass on her best wishes for the festive season.

Kind Regards

s. 22(1)(a)(ii)
Assistant Director | Risk Management and International Engagement| Imported Food Section |s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Travellers, Mail and Imported Food Branch | Biosecurity Operations Division
CQ2, 72 Northbourne Avenue, Canberra City ACT 2601 Australia
GPO Box 858 Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 47F(1) @foodstandards.gov.au>
Sent: Thursday, 15 December 2022 8:47 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

s. 22(1)(a)(ii) **OFFICIAL**

Thanks

I have completed a preliminary risk assessment that is currently with Christel for clearance but the letter will be very helpful so please do send it through.

Are we able to provide you with the preliminary risk assessment before the end of the year in the first instance to help justify/guide the surveillance if it is for something that might pose a risk to public health and safety? Do we need to publish this online in the first instance or can it just be provided to you to help decision making re surveillance? We can then also do up formal risk advice in the standard template for publication on the website in the new year?

s. 47F(1) is across this work and will be able to handle any questions and progress this for you in my absence.

And thank you for the data, that was extremely useful for the RA.

Happy holidays!

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: s. 47F(1)

m: +s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 15 December 2022 8:33 AM
Tos. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

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Hi s. 47F(1)

Thank you for the information.

I am in the process drafting a letter to request formal risk advise for enoki mushrooms.

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 14 December 2022 4:54 PM
Tos. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

FYI just came across this while finishing off advice. FDA recall enoki

https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts/utopia-foods-recalls-enoki-mushrooms-because-possible-health-risk#:~:text=Utopia%20Foods%20Inc%20of%20Glendale,in%20young%20children%2C%20frail%20or

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: s. 47F(1)
m

e: s. 47F(1) @foodstandards.gov.au

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Australia
Tel + 61 2 6271 2222

www.foodstandards.gov.au

Ms Vikki Fischer
Assistant Secretary, Pathway Policy – Travellers, Mail and Imported Food
Department of Agriculture, Fisheries and Forestry
GPO Box 858
Canberra ACT 2601

Dear Vikki

Thank you for your letter of 22 December 2022 seeking advice on enoki mushrooms.

FSANZ will prepare risk advice on *Listeria monocytogenes (L. monocytogenes)* in enoki mushrooms as soon as possible. In preparing this advice we note that other than the information in your letter, other sources of information or data on enoki mushrooms are limited, particularly prevalence data on *L. monocytogenes* as well as consumption data for enoki mushrooms in Australia.

Given previous history of adverse health impacts associated with enoki mushrooms and the recent recalls in the North America, I would like to request the Department of Agriculture, Fisheries and Forestry (DAFF) consider capturing imported enoki mushrooms for border surveillance testing for *L. monocytogenes,* while we complete the risk advice. The data collected should capture prevalence of *L. monocytogenes* and cell counts (ie presence and quantification). Ideally, any isolates detected could be further typed to determine if the same strain currently found in the North America is finding its way to Australia in imported product.

I note DAFF's current risk management strategy on imported enoki mushrooms is a labelling requirement that the product be cooked prior to consumption. In recent international discussions, FSANZ is aware of very high levels of *L. monocytogenes* detected by other countries on imported enoki mushrooms. Due to the high prevalence and potentially high concentrations of *L. monocytogenes* on imported enoki mushrooms, even if cooked most of the time, there is the possibility that a significant risk to public health may currently exist. Surveillance testing will improve our knowledge base about what is present in Australia and the potential risk.

We will also liaise with the jurisdictions to consider investigative testing of product at retail to capture domestically produced enoki mushroom. By combining both sources of data FSANZ will be able to establish the risk posed by enoki mushrooms to the Australian public. Any surveillance testing conducted will provide FSANZ with information on prevalence and concentration of *L. monocytogenes*, providing base line data to support the risk evaluation.

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If you implement surveillance testing of enoki mushrooms, we are open to further discussion on options if high concentrations on product are detected.

We will continue to develop the risk advice and welcome any comments you have on testing options in the meantime.

Yours sincerely

Christel Leemhuis
General Manager, Science and Risk Assessment Branch
Food Standards Australia New Zealand

5 January 2023

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 2 February 2023 2:50 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

s. 22(1)(a)(ii)

Hi

s. 22(1)(a)(ii) x has update the data extract for imported enoki mushrooms (thank you s. 22(1)(a)(ii) and the link to the excel report is saved here.

Please note that:

1. The total quantity of fresh or frozen enoki mushrooms between 2019 and 2022 was 7,634,531.8 kg
2. Import quantities have been increasing year by year between 2019 and 2022 – a 38% increase in total quantity imported in 2020 compared to 2019, a 3.4% increase in total quantity imported in 2021 compared to 2020, and a 7.4% increase in total quantity imported in 2022 compared to 2021.
3. In terms of quantity, 86.5% of enoki mushrooms are imported from Sth Korea. All fresh and frozen product is imported from China and Sth Korea.
4. In 2022, 7 importers brought in product from 11 producers in China; 13 importers brought in product from 21 producers in Sth Korea.

Please let us know if you need anything else.

Cheers,
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Wednesday, 1 February 2023 9:41 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Thanks s. 22(1)(a)(ii) or confirming s. 22(1)(a)(ii) and I will get onto that tomorrow 😊

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Wednesday, 1 February 2023 9:36 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Tomorrow should be fine.

Thanks, s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Wednesday, 1 February 2023 9:29 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

No worrie s. 22(1)(a)(ii)

Is this urgent? Could it wait til tomorrow when both s. 22(1)(a)(i and I are in the office and we can do the data together?

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Wednesday, 1 February 2023 9:26 AM
To: s. 22(1)(a)(ii) @aff.gov.au>s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: FW: FDA recall enoki [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

In s. 22(1)(a)(ii) absence, can you please help with the following data FSANZ is after? See below highlighted in yellow.

Thank you

s. 22(1)(a)(ii)

Froms. 47F(1) foodstandards.govt.nz>
Sent: Wednesday, 1 February 2023 8:37 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @awe.gov.au>s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

s. 22(1)(a)(ii)

Hi

Following on from the meeting we had in January, I have a couple of follow on questions regarding the amount of enoki mushrooms to help inform the risk assessment.

- I just wanted to confirm that there have been 7,395,998 kg enoki mushrooms imported from Republic of Korea and China since 2019?
- Is the same amount imported each year over that period (ie can we divide by 4 to get a yearly import volume) or has there been a significant increase over time?
- I recall that we import more from one of the two countries mentioned. Can you confirm which country that is?

Thanks

s. 47F(1)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 18 January 2023 1:20 pm
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.govt.nz>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

Hi all

Thanks for the meeting – good to have that discussion. Just quickly capturing the action items:

1. DAFF to confirm if a survey is possible (ie purchase post-border/retail imported enoki and test)
    a. If yes, FSANZ to advise number of samples and if all producers from China & South Korea
2. DAFF to consider if advice can be sent to importers or via IFCC
    a. FSANZ to provide key points to be included about potential food safety risk
3. DAFF to review if any producers subject to the recalls in US & Canada are exporting to Australia
4. FSANZ to follow up via SEAWG and whether jurisdictions can test retail product (both domestic and imported)
    a. FSANZ to consider advice on sampling etc
5. FSANZ to continue with risk assessment

Regards
s. 47F(1)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 16 January 2023 3:34 PM
To: s. 47F(1) @foodstandards.govt.nz>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]
Importance: High

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hello s. 47F(1)

I forwarded the attached letter from Christel to Vikki. We discussed the letter and Vikki suggested we have a meeting with you and s. 47F(1)

What is your availability Wednesday and Thursday this week? Apologies for the short notice.

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) s@foodstandards.govt.nz>
Sent: Thursday, 5 January 2023 8:35 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @awe.gov.au>
Ccs. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

s. 22(1)(a)(ii)
Hi

Please find attached a letter from Christel Leemhuis in reply to Ms Fischer's letter dated 22 December 2022 requesting risk advice for imported enoki mushrooms.

As noted in the response we will start preparing the requested risk advice as soon as possible.

If you have any questions or concerns about this work, please do not hesitate to get in touch and we can arrange a suitable meeting time to discuss.

Best Regards

s. 47F(1)

---

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

ts. 47F(1) | m: s. 47F(1)
es. 47F(1) @foodstandards.govt.nz

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 22 December 2022 2:42 pm
To: s. 47F(1) @foodstandards.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Hello s. 47F(1)

Please find attached a letter from Vikki Fischer to Christel Leemhuis requesting formal risk advice for enoki mushrooms.

s. 22(1)(a)(ii) requested not for anything to be published until we had a look at the draft risk advise for enoki mushrooms.

Vikki asked that I pass on her best wishes for the festive season.

Kind Regards

s. 22(1)(a)(ii)
Assistant Director | Risk Management and International Engagement| Imported Food Section |s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Travellers, Mail and Imported Food Branch | Biosecurity Operations Division

CQ2, 72 Northbourne Avenue, Canberra City ACT 2601 Australia
GPO Box 858 Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 47F(1) @foodstandards.gov.au>
Sent: Thursday, 15 December 2022 8:47 AM
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Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

s. 47F(1) **OFFICIAL**

Thanks

I have completed a preliminary risk assessment that is currently with Christel for clearance but the letter will be very helpful so please do send it through.

Are we able to provide you with the preliminary risk assessment before the end of the year in the first instance to help justify/guide the surveillance if it is for something that might pose a risk to public health and safety? Do we need to publish this online in the first instance or can it just be provided to you to help decision making re surveillance? We can then also do up formal risk advice in the standard template for publication on the website in the new year?

s. 47F(1) across this work and will be able to handle any questions and progress this for you in my absence.

And thank you for the data, that was extremely useful for the RA.

Happy holidays!

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: s. 47F(1)
m: s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 15 December 2022 8:33 AM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Hi s. 47F(1)

Thank you for the information.

I am in the process drafting a letter to request formal risk advise for enoki mushrooms.

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 14 December 2022 4:54 PM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

FYI just came across this while finishing off advice. FDA recall enoki

https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts/utopia-foods-recalls-enoki-mushrooms-because-possible-health-risk#:~:text=Utopia%20Foods%20Inc%20of%20Glendale,in%20young%20children%2C%20frail%20or

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: s. 47F(1)
m: s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Monday, 12 December 2022 4:35 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: DATA REQUEST: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]
Attachments: enoki data for s. 22(1)(a)(ii).xlsx

s. 22(1)(a)(ii)
Dear

s. 22(1)(a)(ii) data is accurate and is the total amount for the time period 👍

My data includes ever so slightly more imports (given the different range) and totals: **7'530'824.73 kg** since 2019.

I averaged the 19, 20, 21, 22 import quantities and it is around **~1'882'706.2 kg** of Enoki mushrooms imported per year (see spreadsheet), with the vast majority from Korea, and then China.

Kind Regards,

s. 22(1)(a)(ii)
Technical Officer|Imported Food|Biosecurity Operations Division
Australian Government Department of Agriculture, Fisheries and Forestry
7 London Circuit, CANBERRA ACT 2601 | GPO Box 858, CANBERRA ACT 2601 AUSTRALIA
T: s. 22(1)(a)(ii) M: s. 22(1)(a)(ii) | **E**s. 22(1)(a)(ii)@agriculture.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 12 December 2022 4:10 PM
To: s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: DATA REQUEST: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

Great!

Maybe check if the data s. 22(1)(a) provided is consistent with what you have. She checked from 2019 and provided a total.

Regards
s. 22(1)(a)(ii)

Froms. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 12 December 2022 3:59 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: DATA REQUEST: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

Got it working 😍 ☺

Realized the issue was related to my access to the J-Drive which has given me grief since we left London Circuit.

As to your request for:
The yearly amount of enoki mushrooms that are imported into Australia

How many years back did you want me to look?

Kind Regards,

s. 22(1)(a)(ii)
Technical Officer|Imported Food|Biosecurity Operations Division
Australian Government Department of Agriculture, Fisheries and Forestry
7 London Circuit, CANBERRA ACT 2601 | GPO Box 858, CANBERRA ACT 2601 AUSTRALIA
T: s. 22(1)(a)(ii) M: s. 22(1)(a)(ii) | **E**s. 22(1)(a)(ii)@agriculture.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 12 December 2022 3:27 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: DATA REQUEST: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

Hi s. 22(1)(a)(i

See email attached from s. 22(1)(and the import data she provided. Happy to use this data?

Regards
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 12 December 2022 3:18 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: DATA REQUEST: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

Dear s. 22(1)(a)(ii)

My Power BI is not connecting today for some reason, but shall try again tomorrow when I'm in the office.

Kind Regards,

s. 22(1)(a)(ii)
Technical Officer|Imported Food|Biosecurity Operations Division
Australian Government Department of Agriculture, Fisheries and Forestry
7 London Circuit, CANBERRA ACT 2601 | GPO Box 858, CANBERRA ACT 2601 AUSTRALIA
T: s. 22(1)(a)(ii) | M: s. 22(1)(a)(ii) | **E**s. 22(1)(a)(ii)@agriculture.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 12 December 2022 9:31 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: DATA REQUEST: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

Hello s. 22(1)(a)(ii)

Can you please assist with the following data request from FSANZ:

The yearly amount of enoki mushrooms that are imported into Australia

Regards
s. 22(1)(a)(ii)

From s. 47F(1) @foodstandards.govt.nz>
Sent: Friday, 9 December 2022 12:37 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @awe.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>
Subject: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

OFFICIAL

s. 22(1)(a)(ii)

Hi

I am just following up on a couple of items from the FSANZ-DAFF meeting yesterday.

The first was to confirm that we are in the final stages of revising the draft melon risk statements. We have made edits in response to the comments from Sheba and Nicola. The main change that we have made has been to add some more Australian consumption data, expanding that section of the documents to include data for honeydew, rockmelon and watermelon both as single foods but also consumed as mixed foods (eg fruit salads).

I just wanted to confirm if you would like to see the revised documents again once we have completed revision before we finalise them for clearance and publishing? I am happy to send them through once s. 47F(1) has completed her clearance review. If not, then we will send them on to the General Manager for clearance.

The microbiology team are putting together information on enoki mushrooms due to the identified risk of *Listeria monocytogenes* which s. 47F(1) presented at the meeting yesterday. Is it possible for you to tell us the yearly amount of enoki mushrooms that are imported into Australia?

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1) m: s. 47F(1)
e: s. 47F(1) foodstandards.govt.nz

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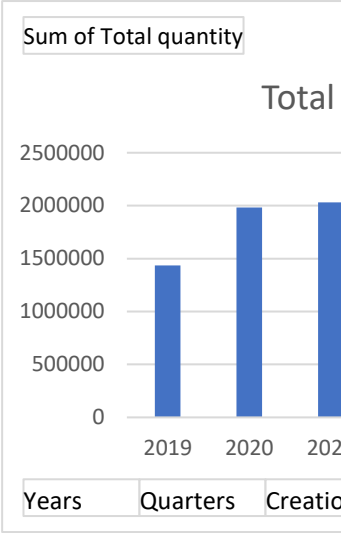
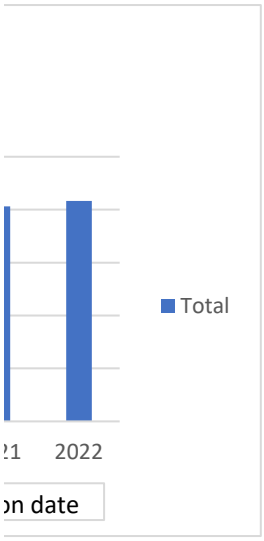
the system manager.
Scanned by Office 365 Email Gateway at Food Standards ANZ.
****

Row Labels	Sum of Total quantity
2019	1435267.14
2020	1982385.68
2021	2031942.05
2022	2081229.86
Grand Total	7530824.73

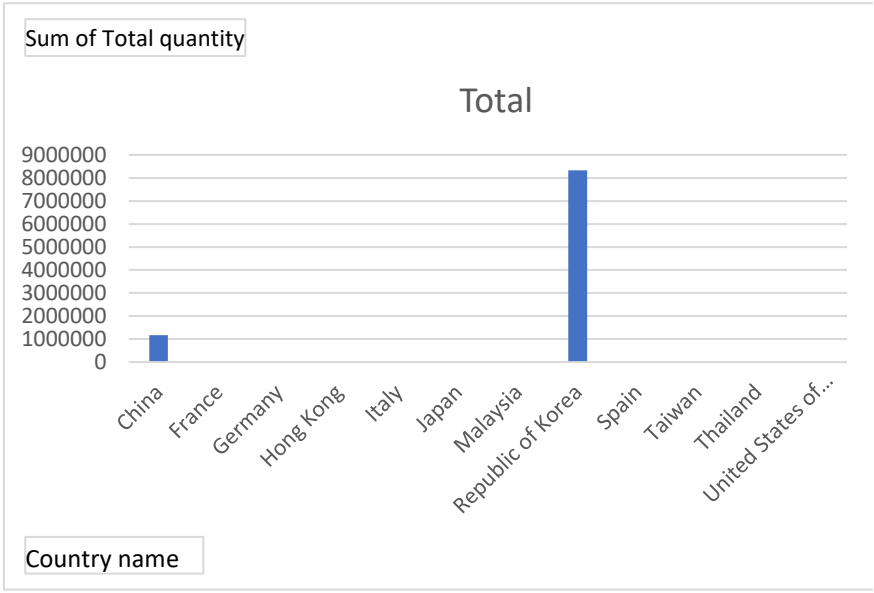
Avg yearly
1882706.2

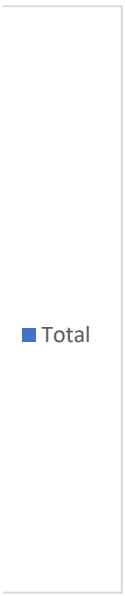


Row Labels
China
France
Germany
Hong Kong
Italy
Japan
Malaysia
Republic of Korea
Spain
Taiwan
Thailand
United States of America
Grand Total



Sum of Total quantity
1171823.02
1
103
42
115.8
2073
13012
8327661.48
12
2363
40
695.3
9517941.6




Total

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 9 March 2023 8:55 AM
To: s. 22(1)(a)(ii)
Subject: FW: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]
Attachments: FSANZ Listeria and enoki RA 2023.docx

See attached advise received.

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 8 March 2023 5:15 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

OFFICIAL: Sensitive

Hi s. 22(1)(a)(ii)

FSANZ has now completed our preliminary risk assessment for *Listeria monocytogenes* and enoki mushrooms.

Cheers,

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology

t:
m s. 47F(1)

e: s. 47F(1) @foodstandards.gov.au

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s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

s. 45, s.47E(d), s. 47B

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

PO Box 5423
KINGSTON ACT 2604
Australia
Tel + 61 2 6271 2222

www.foodstandards.gov.au

Ms Vikki Fischer
Assistant Secretary, Pathway Policy – Travellers, Mail and Imported Food
Department of Agriculture, Fisheries and Forestry
GPO Box 858
Canberra ACT 2601

Dear Vikki

Thank you for your letter of 22 December 2022 seeking advice on enoki mushrooms.

FSANZ will prepare risk advice on *Listeria monocytogenes (L. monocytogenes)* in enoki mushrooms as soon as possible. In preparing this advice we note that other than the information in your letter, other sources of information or data on enoki mushrooms are limited, particularly prevalence data on *L. monocytogenes* as well as consumption data for enoki mushrooms in Australia.

Given previous history of adverse health impacts associated with enoki mushrooms and the recent recalls in the North America, I would like to request the Department of Agriculture, Fisheries and Forestry (DAFF) consider capturing imported enoki mushrooms for border surveillance testing for *L. monocytogenes,* while we complete the risk advice. The data collected should capture prevalence of *L. monocytogenes* and cell counts (ie presence and quantification). Ideally, any isolates detected could be further typed to determine if the same strain currently found in the North America is finding its way to Australia in imported product.

I note DAFF's current risk management strategy on imported enoki mushrooms is a labelling requirement that the product be cooked prior to consumption. In recent international discussions, FSANZ is aware of very high levels of *L. monocytogenes* detected by other countries on imported enoki mushrooms. Due to the high prevalence and potentially high concentrations of *L. monocytogenes* on imported enoki mushrooms, even if cooked most of the time, there is the possibility that a significant risk to public health may currently exist. Surveillance testing will improve our knowledge base about what is present in Australia and the potential risk.

We will also liaise with the jurisdictions to consider investigative testing of product at retail to capture domestically produced enoki mushroom. By combining both sources of data FSANZ will be able to establish the risk posed by enoki mushrooms to the Australian public. Any surveillance testing conducted will provide FSANZ with information on prevalence and concentration of *L. monocytogenes*, providing base line data to support the risk evaluation.

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Te Mana Kounga Kai – Ahitereiria me Aotearoa

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Tel + 61 2 6271 2222

www.foodstandards.gov.au

If you implement surveillance testing of enoki mushrooms, we are open to further discussion on options if high concentrations on product are detected.

We will continue to develop the risk advice and welcome any comments you have on testing options in the meantime.

Yours sincerely

Christel Leemhuis
General Manager, Science and Risk Assessment Branch
Food Standards Australia New Zealand

5 January 2023

OFFICIAL

26.04.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Commented [s. 22(1)]: Please check that the wording of the scope is appropriate.

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* has caused foodborne illness associated with consumption of enoki mushrooms, which are considered to be an RTE food. • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • Australian prevalence data for *Listeria monocytogenes* and enoki mushrooms is limited at this time. Limited US and Canadian prevalence data is available for imported products .

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperature above 50°C is lethal to *Listeria*, but it can survive for long periods at temperatures below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions, and will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement are sterilised prior to use to remove any competing microorganisms. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *Listeria monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it is difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. *Listeria monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates of5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported significant growth of *L. monocytogenes* on enoki stored at 5°C for 30 days with increasing growth rates for increasing temperatures. . Thus, if *Listeria monocytogenes* is present on the enoki mushrooms when packaged, it has the potential to continue to grow to high numbers before consumption in product with extended shelf-life even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels that constitute a public health and safety risk (FSANZ unpublished. Cooler storage temperatures have been shown to control growth - Kim et al (2020) demonstrated no increase in *Listeria monocytogenes* numbers over a period of a month when stored at 1°C.

Commented s. 22(1)(a)(ii) I realise that consumption trends for mushrooms has changed since this data was collected so I was wondering whether it might be possible to use the import numbers for enoki mushrooms from 2010 to 2022 to represent increasing consumer interest and purchasing over this period. I will also be following up with the team here who looks at current trends in food use in Australia.

General description
Enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). The Australian Mushroom Growers Association recommend that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). However, FSANZ notes that there is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food. Additionally, cross-contamination of other foods due to the preparation of enoki carrying high loads of *L. monocytogenes* presents an additional risk to consumers. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, cooked before consumption, and has an extended time before consumption of greater than 14 days predicted a significant high risk of illness if >1 CFU/g is present in the product. To ensure an appropriate level of risk for the Australian populat ion, *Listeria monocytogenes* should not be detectable in125g for these products (FSANZ unpublished)... There are no specific measures reported for the control of *Listeria* in enoki mushrooms although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023), it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life.
Surveillance information: *L. monocytogenes* is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Australia (2023):** K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx **Australia (2023)**: K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022 **US (2022):** Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below). Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains. **Europe (2022):** Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/ **Europe (2022):** Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html **Europe (2022):** Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

General description
of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)
Europe (2022): Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g.
Canada (2021): A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Canada (2021): CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*
A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below: • USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2 resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak. • Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ. • USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died. • USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death.
Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms
The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China (having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023.
A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms.
These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines

Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia.

Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions:

> ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.
>
> ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.

Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions.

As part of the initial risk management response, the Department of Agriculture, Fisheries and Forestry (DAFF) has issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au)) to importers of enoki mushrooms.

General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020).

Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020).

Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017).

There are industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* apply to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.

Management approaches used by overseas countries

The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004).

Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Some products, such as Guatemalan raspberries, are associated with elevated food safety risks and have specific import requirements to minimize potential hazards (CFIA 2019a). Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under

Standards or guidelines
sanitary conditions (CFIA 2019b).Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products form being distributed in the US.

This draft risk statement was compiled in: April 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition. Accessed 23 May 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma. Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to chinahttps://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

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3.11.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* has caused foodborne illness outbreaks associated with consumption of enoki mushrooms. • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • Available evidence indicates that the prevalence and level of *Listeria monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

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General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly suggesting that consumption of enoki mushrooms has also increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *L. monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (e.g. collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. To minimise contamination of enoki mushrooms with *Listeria monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). *L. monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki mushrooms stored at 5°C for 30 days with increasing growth rates at higher temperatures. Thus, if *L. monocytogenes* is present on the enoki mushrooms when packaged and the product has an extended shelf-life (> 14 days), it has the potential

Commented s. 22(1)(a)(ii) Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

Commented s. 22(1)(a)(ii) I have moved the text. I am not aware of any specific routes of contamination by Listeria during production. It could well enter the premises on equipment or people depending on what PPE or sanitization at the entry to the facility is available. Once in the production space it would be difficult to eliminate or control particularly if you have not been completing environmental or product testing on site.

Commented s. 22(1)(a)(ii) What is considered to be 'extended shelf life'?

Commented s. 22(1)(a)(ii) In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented s. 22(1)(a)(ii) Rather than "used" in my comment I should have said "observed"

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General description
to continue to grow to high numbers before consumption, even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels of 10^5-10^7 cells/g that would constitute a public health and safety risk (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *L. monocytogenes* numbers occurring over a period of a month. There is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). The US Mushroom Council states that enoki mushrooms can be consumed either eaten raw in salads or as part of a sandwich or can be used as an ingredient in soups and stocks (US Mushroom Council 2021). However, traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. As there is evidence that these mushrooms are increasingly being used in non-traditional ways (e.g. salads, stir fries), where they present an increased risk for listeriosis. If the producers of enoki mushrooms intend that the mushrooms to be consumed cooked, appropriate cooking instructions should be provided on the packaging, as required in Standard 1.2.6 of the Food Standards Code. There are no specific measures reported for the control of *L. monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, has an extended storage time before consumption of between 35 and 55 days, cooked before consumption, and where cooking as a 99% effectiveness (ie "usually eliminates the hazard") predicted a significant high risk of illness if >10 CFU/g is present in the product where the serving size was 100g. Cooking time/temperatures required to achieve a 6D reduction of *L. monocytogenes* are 65°C for 9.3 minutes, 70°C for 2 minutes and 80°C and 85°C for 0.09 and 0.02 minutes respectively (FDA Guidelines). Therefore to ensure an appropriate level of risk for the Australian population, *L. monocytogenes* should not be detectable in a composite 125g sample (5x 25g) for enoki mushrooms (FSANZ unpublished). Enoki mushrooms should be considered a potentially hazardous food due to the potential presence of *L. monocytogenes* that can grow on this product during storage. Through-chain controls are needed during production, processing and post processing including refrigeration and, regardless of the storage instructions, thorough cooking before consumption to reduce the risk of illness from this product is recommended.
Surveillance information: Listeriosis is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Canada (2023):** Golden Mushroom brand enoki mushrooms from Republic of Korea were recalled on 16th September 2023 due to the detection of *Listeria monocytogenes* during CFIA testing. Golden Mushroom brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca **Canada (2023):** Lian Teng brand enoki mushrooms were recalled on 16th October 2023 due to the detection of *L. monocytogenes* during CFIA testing. Lian Teng brand "Champignon Énoki" (Enoki Mushrooms) recalled due to Listeria monocytogenes - Canada.ca **Canada (2023):** Super brand enoki mushrooms were recalled on 19th September 2023 due to the detection of *Listeria monocytogenes* during CFIA testing. Super brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca

Commented s. 22(1)(a)(ii) What level is constitutes a public health and safety risks?

Commented s. 22(1)(a)(ii) Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented s. 22(1)(a)(ii) For healthy adults the infectious dose can be as high as 10E9 cells

Commented s. 22(1)(a)(ii) I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these mushrooms raw or that they are being eaten this way?

Commented s. 22(1)(a)(ii) Yes, the cited page is still on their website. I have amended the wording so it is as written on the web page

Commented s. 22(1)(a)(ii) Or regardless of the intention of the producer in relation to end use, are we saying that all enoki mushrooms must be cooked prior to consumption to minimise risk of listeriosis?

Commented s. 22(1)(a)(ii) The code does not specify any requirements for enoki but the intended use or storage conditions need to be if there is a risk to human health. So my reading of this as it currently stands it is down to the producer to manage the risk either through processing, active monitoring programme and/or approriate labelling.

Commented s. 22(1)(a)(ii) This para needs strengthening to explain the risk with eating enoki raw, lightly cooked and fully cooked. If there is still a risk, even after thorough cooking, then this needs to be clear. Also should be clear what cooking times/temperatures the modelling considered?

Commented s. 22(1)(a)(ii) Have added additional information.

Commented s. 22(1)(a)(ii) Can we be clear here that this advice stands whether or not the product includes storage instructions on the label?

Commented [s. 22(1)(a)(ii) I have modified the wording in the next paragraph. Does this change address you comment adequately?

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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General description
Canada (2023): SSS brand enoki mushrooms from China were recalled on 28th July 2023 due to the detection of *Listeria monocytogenes* during CFIA testing. SSS brand Mushroom (enoki) recalled due to Listeria monocytogenes - Canada.ca
Australia (2023): 5 further recalls based detections during testing across different states and territories: Fruit Perfection Pty LTD (from Korea) – 2nd June 2023; Natural Mushroom (from China) -27th June 2023; Korea Connections (from Korea) – 9th May 2023; KO Food Australia Pty LTD (from Korea) – 7th June 2023; Concordia Traders (Aust) Pty LTD (from China) 28th June 2023. Current food recalls (foodstandards.gov.au)
Australia (2023): K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx
Australia (2023): K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx
US (2022): Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022
US (2022): Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below).
Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains.
Europe (2022): Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/
Europe (2022): Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html
Europe (2022): Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)
Europe (2022): Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g.
Canada (2021): A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Canada (2021): CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*
A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below:
• USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2

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resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak.

- Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ.
- USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died.
- USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death.

Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms

In 2023, FSANZ coordinated an Australian national survey of imported and domestic enoki. The results indicate that 34/299 (11%) imported enoki samples were contaminated with *L. monocytogenes* at concentrations up to 11,000 CFU/g. The mean contamination level was 1,250 CFU/g. No detections of *L. monocytogenes* were observed in the 36 domestic samples.

Food Standards Agency and Food Standards Scotland issued an advisory notice in 2023 to vulnerable consumers to thoroughly cook enoki mushrooms following sampling data found the presence of *L. monocytogenes* in 13 of 40 (32.5%) samples tested, some of which were at high levels. Contaminated mushrooms were imported from China, Korea, Thailand and other Asian countries. (FSS and the FSA advise on Listeria monocytogenes in imported Enoki mushrooms | Food Standards Scotland)

The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China (having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023.

A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms.

These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines

Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia.

Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions:

> ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.
>
> ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.

Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions.

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Standards or guidelines
In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in these mushrooms. General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There is industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

This draft risk statement was compiled in: November 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA Appendix 4- Bacterial pathogen growth and inactivation. https://www.fda.gov/media/80390/download Accessed August 2023.

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition Accessed August 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma . Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

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14.11.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: þ *Yes* ¨ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* can be present in enoki mushrooms and foodborne illness outbreaks have been associated with the consumption of enoki mushrooms, including in Australia • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • A cooking step such as boiling enoki mushroom should eliminate the hazard. However, there is evidence of consumption without adequate cooking. • Available evidence indicates that the prevalence and level of *L. monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered

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mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013). Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. Approximately 43% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 33% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly indicating that consumption of enoki mushrooms has increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than other sectors of the population. Those unfamiliar with enoki mushrooms may still consume them occasionally and may consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including from China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *L. monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (e.g. collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. To minimise contamination of enoki mushrooms with *L. monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). *L. monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C:

Commented s. 22(1)(a)(ii) Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

Commented s. 22(1)(a)(ii) I have moved the text. I am not aware of any specific routes of contamination by Listeria during production. It could well enter the premises on equipment or people depending on what PPE or sanitization at the entry to the facility is available. Once in the production space it would be difficult to eliminate or control particularly if you have not been completing environmental or product testing on site.

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1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki mushrooms stored at 5°C for 30 days with increasing growth rates at higher temperatures. Thus, if *L. monocytogenes* is present on the enoki mushrooms when packaged and the product has an extended shelf-life (> 14 days), it has the potential to grow to high numbers before consumption, even if refrigerated. Application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly. However, depending upon the initial contamination level, combined with longer storage times at temperatures of 5°C to ambient for both transport and storage, it is likely that the concentration of *Listeria* could increase to levels of 10^5-10^7 cells/g. This would constitute a public health and safety risk, particularly for vulnerable populations (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *L. monocytogenes* numbers occurring over a period of a month. Consumer advice varies on the suitability of enoki mushrooms to be consumed raw. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). The US Mushroom Council states that enoki mushrooms can be consumed either eaten raw in salads or as part of a sandwich or can be used as an ingredient in soups and stocks (US Mushroom Council 2021). However, traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. As there is evidence these mushrooms are being used in non-traditional ways (e.g. salads, stir fries), they present an increased risk for listeriosis. There are no specific measures reported for the control of *L. monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. **Risk assessment by FSANZ to inform risk management** A risk assessment was undertaken by FSANZ to determine if a significant public health and safety risk is posed by *L. monocytogenes* and imported raw enoki mushrooms, and to provide scientific justification for risk management measures that can be applied to provide an appropriate level of risk for consumers. This also included consideration of applying a Performance Objective at the Australian border to achieve an appropriate level of risk. A Performance objective (PO) is defined as the maximum frequency and/or concentration of a hazard in a food at a specified step in the food chain before the time of consumption that provides or contributes to an appropriate level of risk. The semi-quantitative risk assessment, estimated risk of illness to Australian consumers based on assumptions that: • all imported enoki is refrigerated at 5°C post border • has a storage time before consumption of between 14 and 55 days post border entry • is cooked before consumption, and • where cooking is 99% effectiveness (ie "usually eliminates the hazard"). This modelling estimated a medium to high risk of illness if 10% of imported enoki was contaminated at levels of 1,000 CFU/g where the serving size was 100g. Additionally, a high risk was estimated if 15% of imported enoki was assumed to be consumed raw between 14 and 35 days post border entry. The outcomes of the risk assessment also demonstrated that: • labelling is required to reduce risk but alone is insufficient to reduce the public health and safety risk posed by imported enoki under reasonably foreseeable conditions of use; • enoki must be refrigerated through-chain once packaged, and must be labelled to be refrigerated and cooked thoroughly to reduce the risk of illness from this product; • risk increases with a longer shelf-life. Product at the Australian border with a remaining shelf-life datemarked >35 days should not be considered safe and suitable unless evidence validating the date-marking can be provided. Additionally, food businesses should ensure that any and all date-marking are validated; and • applying a PO of *L. monocytogenes* not detected in five 25g samples of enoki from a lot , even if appropriate labelling is present, can contribute to reducing risk to an appropriate level. Enoki mushrooms can be considered a potentially hazardous food due to the potential presence of *L. monocytogenes* that can grow on this product during storage. Cooking time/temperatures required to achieve a 6D reduction of *L. monocytogenes* are 65°C for 9.3 minutes, 70°C for 2 minutes and 80°C and 85°C for 0.09 and 0.02 minutes respectively (FDA Guidelines). As such, it is also recommended to increase clarity of instructions for example labelling "Must be refrigerated below 5°C" and "Cook thoroughly at 70°C for at least 2 min". A through-chain risk management approach starting at primary production will be required to provide safe and suitable product, regardless of the storage instructions, and should also include environmental monitoring of *Listeria*.

**Commented [s. 22(1)(a What is considered to be 'extended shelf life'?

Commented s. 22(1)(a)(ii): In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented s. 22(1)(a)(ii) Rather than "used" in my comment I should have said "observed"

Commented s. 22(1)(a)(ii)What level is constitutes a public health and safety risks?

Commented s. 22(1)(a)(ii) Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented s. 22(1)(a)(ii): For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a)(ii)]: So would indicate it poses a risk to vul pops, not the general pop, until there was another 10E2 increase?

Commented [s. 22(1)(a)(ii)]: Modified

Commented [s. 22(1)(a)]: I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these mushrooms raw or that they are being eaten this way?

Commented [s. 22(1)(a)(ii)]: Yes, the cited page is still on their website. I have amended the wording so it is as written on the web page

Commented [s. 22(1)(]: Alternative wording: The risk assessment outcomes and the potentially hazardous nature of packaged enoki, indicate that product may not be considered safe and suitable if any of the following is true:

- There are no refrigeration instructions on packages for retail sale or accompanying bulk consignments.
- There are no cooking instructions on packages for retail sale or accompanying bulk consignments.
- There are no date marks on packages for retail sale or accompanying bulk consignments.
- *L. monocytogenes* is detected in at least one of five 25g samples taken from a lot at point of entry at the Australian border, regardless of labelling.
- Product at the Australian border has a remaining shelf-life datemarked >35 days

Commented [s. 22(1)(a]: We are not sure of how this would work at the border s. 22(1)(a

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General description

Surveillance information:

Listeriosis is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year). It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness.

Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)

Canada (2021-2023):

- 16 September 2023: Golden Mushroom. Golden Mushroom brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca
- 16th October 2023 Lian Teng. Lian Teng brand "Champignon Énoki" (Enoki Mushrooms) recalled due to Listeria monocytogenes - Canada.ca
- 19th September 2023: Super brand. Super brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca
- 28th July 2023: SSS brand. SSS brand Mushroom (enoki) recalled due to Listeria monocytogenes - Canada.ca
- 15 May 2021: Ravine Mushroom Farms. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
- 7 May 2021: Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca

Australia (2023):

- 28th June 2023: Concordia Traders (Aust) Pty LTD. Current food recalls (foodstandards.gov.au)
- 27th June 2023: Natural Mushroom. Current food recalls (foodstandards.gov.au)
- 7th June 2023: KO Food Australia Pty LTD. Current food recalls (foodstandards.gov.au)
- 2nd June 2023: Fruit Perfection Pty LTD. Current food recalls (foodstandards.gov.au)
- 9th May 2023: Korea Connections. Current food recalls (foodstandards.gov.au)
- 6th April 2023: K-mama https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx
- 10th March 2023: K-mama https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx

US (2022):

- 17th November 2022: Green Day Produce Ltd
- 13th December 2022**:** Utopia Foods

Note: FDA surveillance found many samples of enoki mushrooms were contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains.

Europe (2022):

- 13 May 2022: Ireland,: RASFF notification (2022.2633) Green Box Ltd Cendawan https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html
- 5 May 2022: Slovenia: RASFF notification (2022.2633) Green Box Ltd Cendawan Quantitative sampling detected levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/
- 25th March 2022: Netherlands: RASFF notification (2022.1779) Quantitative sampling detected levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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- 15th February 2022: Netherlands: RASFF notification (2022.1776). Quantitative sampling detected levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. RASFF Window - Notification detail (europa.eu)

Illness associated with consumption of enoki mushrooms contaminated with *Listeria monocytogenes*

A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms.

USA (2016-2022):

- 2022: A recall of Utopia Foods Inc. of Glendale NY, November 2022 and expanded on 13 December 2022. As of 7 April 2023, 5 people infected and hospitalised were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada.
- 2020: As of 9 June 2020, 36 people were infected by *L. monocytogenes* from 17 states. 31 were hospitalised, 4 died and 2 foetal losses in 6 pregnancy-associated cases. Source identified as enokitake mushrooms supplied by Green Co. LTD.
- 2017: *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 ill patients, one died.
- 2016: multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 reported illnesses; 4 died.

Australia (2017-2020):

- 6 cases were notified between October 2017 and March 2020. Product was recalled on 10 April 2020. The strains were shown to be related to the USA outbreak strain via whole genome sequencing.

Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms

In 2023, FSANZ coordinated an Australian national survey of imported and domestic enoki. The results indicate that 34/299 (11%) imported enoki samples were contaminated with *L. monocytogenes* at concentrations up to 11,000 CFU/g. The mean contamination level was 1,250 CFU/g. No detections of *L. monocytogenes* were observed in the 36 domestic samples.

Food Standards Agency and Food Standards Scotland issued an advisory notice in 2023 to vulnerable consumers to thoroughly cook enoki mushrooms following sampling data found the presence of *L. monocytogenes* in 13 of 40 (32.5%) samples tested. Contaminated mushrooms were imported from China, Korea, Thailand and other Asian countries. (FSS and the FSA advise on Listeria monocytogenes in imported Enoki mushrooms | Food Standards Scotland)

The US FDA's (2023) national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea and the People's Republic of China, showed 43% and 15% of the samples respectively were positive for *L. monocytogenes*.

A search of scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms; 3 from China and one from Spain. They indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines

Whole fruit and vegetables, including whole fungi, are exempt, by definition, from *L. monocytogenes* limits for ready-to-eat foods and labelling requirements of the Australia New Zealand Food Standards Code.

In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in enoki mushrooms.

General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020).

Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020).

Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017).

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Standards or guidelines
There are industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). Currently, enoki is held until tests confirm *L. monocytogenes* is not detected in a lot. In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). Currently, to secure release of an individual shipment subject to detention without physical examination under this import alert, the owner, consignee, and/or other responsible party for the affected goods would provide evidence that the product does not bear or contain *L. monocytogenes*. The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

This draft risk statement was compiled in: November 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA Appendix 4- Bacterial pathogen growth and inactivation. https://www.fda.gov/media/80390/download Accessed August 2023.

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition Accessed August 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma . Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

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29.06.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* has caused foodborne illness outbreaks associated with consumption of enoki mushrooms. • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • Available evidence indicates that the prevalence and level of *Listeria monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

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General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly suggesting that consumption of enoki mushrooms has also increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. To minimise contamination of enoki mushrooms with *Listeria monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *Listeria monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (eg collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. *Listeria monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki stored at 5°C for 30 days with increasing growth rates for increasing temperatures. Thus, if *Listeria monocytogenes* is present on the

Commented [s. 22(1)(a)(ii): Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

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enoki mushrooms when packaged and has an extended shelf-life (> 14 days), it has the potential to continue to grow to high numbers before consumption, even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels that constitute a public health and safety risk (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *Listeria monocytogenes* numbers occurring over a period of a month. ~~Enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). There is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food.~~ The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). ~~However, FSANZ notes that there is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food.~~ The US Mushroom Council states that enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). However, ~~T~~traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. ~~However~~ As there is evidence that these mushrooms are increasingly being used in non-traditional ways (eg salads, stir fries), they present an increased risk ~~hence increasing the risk of~~ for listeriosis. If the producers of the mushrooms intend the mushrooms ~~As these mushrooms are intended~~ to be consumed cooked, appropriate cooking instructions should be provided on the packaging, as required in Standard 1.2.6 of the Code. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, cooked before consumption, and has an extended storage time before consumption of greater than 14 days predicted a significant high risk of illness if >1 CFU/g is present in the product. To ensure an appropriate level of risk for the Australian population, *Listeria monocytogenes* should not be detectable in a composite 125g sample (5x 25g) for these products (FSANZ unpublished). There are no specific measures reported for the control of *Listeria monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. Enoki mushrooms should be considered a potentially hazardous food due to the presence of *L. monocytogenes* that can grow on this product. Through-chain controls are needed during production, processing and post processing including refrigeration and thorough cooking before consumption. ~~are required~~ to reduce the risk of illness from this product.
Surveillance information: *L. monocytogenes* is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Australia (2023):** K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx **Australia (2023)**: K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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Commented [s. 22(1)]: What is considered to be 'extended shelf life'?

Commented [s. 22(1)(a)(ii)]: In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented [s. 22(1)(a)(ii)]: Rather than "used" in my comment I should have said "observed"

Commented [s. 22(1)(a]: What level is constitutes a public health and safety risks?

Commented [s. 22(1)(a)(ii)]: Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented s. 22(1)(a)(ii)**]:** For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a]: Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii)]: Added a sentence to cover this

Commented s. 22(1)(a)**]:** Need to include additional text to explain that in ethnic groups that use these mushrooms in traditional cooking, the mushrooms are boiled before being cooked. However, these mushrooms are increasingly being used in non-traditional ways such as in salads, stir fries etc. This creates additional risks. We also need to explain that if these mushrooms are not intended to be eaten without thorough cooking, then the Code requires these instructions to be included. This isn't occurring and in any case, places a lot of responsibility on the consumer to ensure the safety of the food before it is eaten.

Commented s. 22(1)(a)(ii) **:** I have added some wording around this - see highlighted in yellow

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Commented [s. 22(1)(a)(ii) I have added some wording around this - see highlighted in yellow

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Commented s. 22(1)(a)(ii) **]:** Added a sentence to cover this

Commented s. 22(1)(a)**]:** I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these ...

Commented [s. 22(1)(a)]: Or regardless of the intention of the producer in relation to end use, are we saying that all enoki ...

Commented [s. 22(1)(a)]: Do you mean not cooked or not sufficiently cooked before consumption?

Commented [s. 22(1)(a)(ii)8]: No this was modelled for cooked enoki

Commented s. 22(1)(a)**]:** This para needs strengthening to explain the risk with eating enoki raw, lightly cooked and full ...

Commented s. 22(1)(a)(ii)**]:** Can we be clear here that this advice stands whether or not the product includes storage instructio ...

Commented s. 22(1)(a)(ii)**]:** Apart from thoroughly cooking before consuming!

Commented s. 22(1)(a**]:** Anything on storage of enoki?

Commented [s. 22(1)(a)(ii) **:** Only that they should be stored at refrigeration temperatures. It has been difficult to determine ...

Commented s. 22(1)(a)**]:** Suggest this para should proceed the one above.

General description
US (2022): Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below). Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains. **Europe (2022):** Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/ **Europe (2022):** Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html **Europe (2022):** Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu) **Europe (2022):** Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. **Canada (2021):** A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Canada (2021):** CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*** A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below: • USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2 resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak. • Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ. • USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died. • USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death. **Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms** The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China

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(having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023. A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms. These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines
Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia. Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions: ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions. In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in these mushrooms. General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There is industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be “primary food production”). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries

Standards or guidelines
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

Commented s. 22(1)(a)(i): Any information on NZ?

Commented [s. 22(1)(a)(ii) **:** I have asked and at this point in time MPI is not doing anything specific for enoki. I am not sure how much is being imported but as far as I am aware there have not been any cases reported that have been linked to enoki mushrooms.

Commented s. 22(1)(a)(i): What do these alerts say? Are these products banned from being imported?

Commented [s. 22(1)(a)(ii) **:** No they are not banned. It is only to prevent contaminated product entering the US, and so any suspect product can be detained without inspection. I have expanded this by including a quote from the Import Alert.

This draft risk statement was compiled in: June 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition. Accessed 23 May 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma. Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

OFFICIAL

29.06.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Commented [s. 22(1)(a)(i)Please check that the wording of the scope is appropriate.

Commented s. 22(1)(a)(ii) Can we use the term "not ready-to-eat (NRTE)" with enoki mushrooms for clarity? Is it feasible? https://www.cabdirect.org/cabdirect/abstract/20093136032

Commented s. 22(1)(a)(ii)**:** In the scope, we don't want to refer to NRTE as it doesn't matter whether the mushrooms are ready to eat or not as both present a medium to high risk to public health. However, in the advice it should be clear that both are included and why.

Commented [s. 22(1)(a)(ii)**:** Will leave as written now

Recommendation and rationale

Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health:

☑ *Yes*

☐ *No*

Rationale:

- *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%.
- There is strong evidence that *L. monocytogenes* has caused foodborne illness outbreaks associated with consumption of enoki mushrooms.
- The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur.
- Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures.
- Available evidence indicates that the prevalence and level of *Listeria monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description

Nature of the microorganism:

Listeria monocytogenes is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013).

L. monocytogenes is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).

Adverse health effects:

For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013).

In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly suggesting that consumption of enoki mushrooms has also increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. To minimise contamination of enoki mushrooms with *Listeria monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *Listeria monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (eg collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. *Listeria monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki stored at 5°C for 30 days with increasing growth rates for increasing temperatures. Thus, if *Listeria monocytogenes* is present on the

Commented [s. 22(1)(a)**]:** I realise that consumption trends for mushrooms has changed since this data was collected so I was wondering whether it might be possible to use the import numbers for enoki mushrooms from 2010 to 2022 to represent increasing consumer interest and purchasing over this period. I will also be following up with the team here who looks at current trends in food use in Australia.

Commented [s. 22(1)(a)**]:** Import data fresh enoki mushrooms (2010-2022) sent 2 May 2023

Commented s. 22(1)(a)(ii) Agree that is would be useful to include import data, particularly upwards trend with volumes of imports - assuming that is the case!

Commented s. 22(1)(a)(ii)**:** I have added in import data.

Commented s. 22(1)**]:** 'Good food safety practices' should be made clearer.

Commented [s. 22(1)(a)(ii)**]:** I have added this point into the text. Highlighted in yellow

Commented [s. 22(1)(a)**]:** Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

Commented [s. 22(1)(a)**]:** What is considered 'significant growth'?

Commented [s. 22(1)(a)(ii)**] :** Removed the "significant" from the statement. Key message here is that it can grow on enoki at refrigeration temperatures.

General description
enoki mushrooms when packaged and has an extended shelf-life (> 14 days), it has the potential to continue to grow to high numbers before consumption, even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels that constitute a public health and safety risk (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *Listeria monocytogenes* numbers occurring over a period of a month. ~~Enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). There is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food.~~ The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). ~~However, FSANZ notes that there is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food.~~ The US Mushroom Council states that enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). However, ~~T~~traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. ~~, however~~ As there is evidence that these mushrooms are increasingly being used in non-traditional ways (eg salads, stir fries), they present an increased risk ~~hence increasing the risk of~~ for listeriosis. If the producers of the mushrooms intend the mushrooms ~~As these mushrooms are intended~~ to be consumed cooked, appropriate cooking instructions should be provided on the packaging, as required in Standard 1.2.6 of the Code. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, cooked before consumption, and has an extended storage time before consumption of greater than 14 days predicted a significant high risk of illness if >1 CFU/g is present in the product. To ensure an appropriate level of risk for the Australian population, *Listeria monocytogenes* should not be detectable in a composite 125g sample (5x 25g) for these products (FSANZ unpublished). There are no specific measures reported for the control of *Listeria monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. Enoki mushrooms should be considered a potentially hazardous food due to the presence of *L. monocytogenes* that can grow on this product. Through-chain controls are needed during production, processing and post processing including refrigeration and thorough cooking before consumption. ~~are required~~ to reduce the risk of illness from this product.
Surveillance information: *L. monocytogenes* is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Australia (2023):** K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx **Australia (2023)**: K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

Commented [s. 22(1)(a)]: What is considered to be 'extended shelf life'?

Commented [s. 22(1)(a)(ii) : In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented [s. 22(1)(a)(ii) : Rather than "used" in my comment I should have said "observed"

Commented s. 22(1)(a)]: What level is constitutes a public health and safety risks?

Commented s. 22(1)(a)(ii)]: Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented [s. 22(1)(a)(ii) : For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a)]: Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii)]: Added a sentence to cover this

Commented [s. 22(1)(a)(ii)]: Need to include additional text to explain that in ethnic groups that use these mushrooms in traditional cooking, the mushrooms are boiled before being cooked. However, these mushrooms are increasingly being used in non-traditional ways such as in salads, stir fries etc. This creates additional risks. We also need to explain that if these mushrooms are not intended to be eaten without thorough cooking, then the Code requires these instructions to be included. This isn't occurring and in any case, places a lo ...

Commented [s. 22(1)(a)(ii)]: I have added some wording around this - see highlighted in yellow

Commented [s. 22(1)(a)(ii)]: Need to include additional text to explain that in ethnic groups that use these mushrooms in ...

Commented s. 22(1)(a)(ii) : I have added some wording around this - see highlighted in yellow

Commented [s. 22(1)(a)]: Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii) : Added a sentence to cover this

Commented [s. 22(1)(a)(ii)]: I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these ...

Commented s. 22(1)(a)(ii) Or regardless of the intention of the producer in relation to end use, are we saying that all enoki ...

Commented [s. 22(1)(a)]: All consumers or just at risk consumers?

Commented s. 22(1)(a)(ii)]: Applies to all consumers

Commented [s. 22(1)(a)]: Do you mean not cooked or not sufficiently cooked before consumption?

Commented [s. 22(1)(a)(ii) : No this was modelled for cooked enoki

Commented [s. 22(1)(a)]: This para needs strengthening to explain the risk with eating enoki raw, lightly cooked and full ...

Commented [s. 22(1)(a)]: Can we be clear here that this advice stands whether or not the product includes storage instructio ...

Commented s. 22(1)(a)]: Apart from thoroughly cooking before consuming!

Commented [s. 22(1)]: Anything on storage of enoki?

Commented [s. 22(1)(a)(ii) : Only that they should be stored at refrigeration temperatures. It has been difficult to determine ...

Commented s. 22(1)(a)]: Suggest this para should proceed the one above.

General description
US (2022): Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below). Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains. **Europe (2022):** Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/ **Europe (2022):** Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html **Europe (2022):** Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu) **Europe (2022):** Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. **Canada (2021):** A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Canada (2021):** CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*** A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below: • USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2 resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak. • Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ. • USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died. • USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death. **Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms** The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China

General description
(having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023. A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms. These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines
Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia. Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions: ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions. In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in these mushrooms. General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There is industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be “primary food production”). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries

Standards or guidelines
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

Commented s. 22(1)(a)**]:** Any information on NZ?

Commented s. 22(1)(a)(ii) **:** I have asked and at this point in time MPI is not doing anything specific for enoki. I am not sure how much is being imported but as far as I am aware there have not been any cases reported that have been linked to enoki mushrooms.

Commented s. 22(1)(a)(ii) What do these alerts say? Are these products banned from being imported?

Commented s. 22(1)(a)(ii) No they are not banned. It is only to prevent contaminated product entering the US, and so any suspect product can be detained without inspection. I have expanded this by including a quote from the Import Alert.

This draft risk statement was compiled in: June 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition. Accessed 23 May 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma. Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Thursday, 2 November 2023 10:21 PM
To: s. 22(1)(a)(ii)
Cc: s. 47F(1)
Subject: Risk Statement for Enoki Mushrooms and Listeria [SEC=OFFICIAL]
Attachments: Revised draft statement Lmono on enoki mushroom_V2 03 11 2023.docx

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Hi s. 22(1)(a)(ii)

Please find attached a draft copy of the revised risk statement for Enoki Mushrooms and *Listeria* for your review. Apologises that it was a little later than I intended.

I have addressed s. 22(1)(a)(ii) comments as replies and highlighted the areas in yellow where I have modified the text.

I have also updated the document to include the results from the 2023 Australian survey and also recent recalls both in Australia and overseas. I have also included results from a recent UK survey and a link to their advisory notice.

If you have any questions, please let me know. I look forward to receiving your comments in due course.

Regards

s. 47F(1)

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3.11.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* has caused foodborne illness outbreaks associated with consumption of enoki mushrooms. • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • Available evidence indicates that the prevalence and level of *Listeria monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

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General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly suggesting that consumption of enoki mushrooms has also increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *L. monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (e.g. collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. To minimise contamination of enoki mushrooms with *Listeria monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). *L. monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki mushrooms stored at 5°C for 30 days with increasing growth rates at higher temperatures. Thus, if *L. monocytogenes* is present on the enoki mushrooms when packaged and the product has an extended shelf-life (> 14 days), it has the potential

Commented [s. 22(1)]: Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

Commented [s. 22(1)(a)(ii)]: I have moved the text. I am not aware of any specific routes of contamination by Listeria during production. It could well enter the premises on equipment or people depending on what PPE or sanitization at the entry to the facility is available. Once in the production space it would be difficult to eliminate or control particularly if you have not been completing environmental or product testing on site.

Commented [s. 22(1)]: What is considered to be 'extended shelf life'?

Commented [s. 22(1)(a)(ii)] In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented [s. 22(1)(a)(ii)] Rather than "used" in my comment I should have said "observed"

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General description
to continue to grow to high numbers before consumption, even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels of 10^5-10^7 cells/g that would constitute a public health and safety risk (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *L. monocytogenes* numbers occurring over a period of a month. There is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). The US Mushroom Council states that enoki mushrooms can be consumed either eaten raw in salads or as part of a sandwich or can be used as an ingredient in soups and stocks (US Mushroom Council 2021). However, traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. As there is evidence that these mushrooms are increasingly being used in non-traditional ways (e.g. salads, stir fries), where they present an increased risk for listeriosis. If the producers of enoki mushrooms intend that the mushrooms to be consumed cooked, appropriate cooking instructions should be provided on the packaging, as required in Standard 1.2.6 of the Food Standards Code. There are no specific measures reported for the control of *L. monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, has an extended storage time before consumption of between 35 and 55 days, cooked before consumption, and where cooking as a 99% effectiveness (ie "usually eliminates the hazard") predicted a significant high risk of illness if >10 CFU/g is present in the product where the serving size was 100g. Cooking time/temperatures required to achieve a 6D reduction of *L. monocytogenes* are 65°C for 9.3 minutes, 70°C for 2 minutes and 80°C and 85°C for 0.09 and 0.02 minutes respectively (FDA Guidelines). Therefore to ensure an appropriate level of risk for the Australian population, *L. monocytogenes* should not be detectable in a composite 125g sample (5x 25g) for enoki mushrooms (FSANZ unpublished). Enoki mushrooms should be considered a potentially hazardous food due to the potential presence of *L. monocytogenes* that can grow on this product during storage. Through-chain controls are needed during production, processing and post processing including refrigeration and, regardless of the storage instructions, thorough cooking before consumption to reduce the risk of illness from this product is recommended.
Surveillance information: Listeriosis is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Canada (2023):** Golden Mushroom brand enoki mushrooms from Republic of Korea were recalled on 16th September 2023 due to the detection of *Listeria monocytogenes* during CFIA testing. Golden Mushroom brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca **Canada (2023):** Lian Teng brand enoki mushrooms were recalled on 16th October 2023 due to the detection of *L. monocytogenes* during CFIA testing. Lian Teng brand "Champignon Énoki" (Enoki Mushrooms) recalled due to Listeria monocytogenes - Canada.ca **Canada (2023):** Super brand enoki mushrooms were recalled on 19th September 2023 due to the detection of *Listeria monocytogenes* during CFIA testing. Super brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)
[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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Commented [s. 22(1)(a)What level is constitutes a public health and safety risks?

Commented [s. 22(1)(a)(ii) Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented [s. 22(1)(a)(ii) For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a)I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these mushrooms raw or that they are being eaten this way?

Commented [s. 22(1)(a)(ii) Yes, the cited page is still on their website. I have amended the wording so it is as written on the web page

Commented [s. 22(1)(a)(ii)Or regardless of the intention of the producer in relation to end use, are we saying that all enoki mushrooms must be cooked prior to consumption to minimise risk of listeriosis?

Commented [s. 22(1)(a)(ii) The code does not specify any requirements for enoki but the intended use or storage conditions need to be if there is a risk to human health. So my reading of this as it currently stands it is down to the producer to manage the risk either through processing, active monitoring programme and/or approriate labelling.

Commented [s. 22(1)(a)(ii)This para needs strengthening to explain the risk with eating enoki raw, lightly cooked and fully cooked. If there is still a risk, even after thorough cooking, then this needs to be clear. Also should be clear what cooking times/temperatures the modelling considered?

Commented [s. 22(1)(a)(ii) Have added additional information.

Commented [s. 22(1)(a)(ii)Can we be clear here that this advice stands whether or not the product includes storage instructions on the label?

Commented [s. 22(1)(a)(ii) I have modified the wording in the next paragraph. Does this change address you comment adequately?

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General description
Canada (2023): SSS brand enoki mushrooms from China were recalled on 28th July 2023 due to the detection of *Listeria monocytogenes* during CFIA testing. SSS brand Mushroom (enoki) recalled due to Listeria monocytogenes - Canada.ca
Australia (2023): 5 further recalls based detections during testing across different states and territories: Fruit Perfection Pty LTD (from Korea) – 2nd June 2023; Natural Mushroom (from China) -27th June 2023; Korea Connections (from Korea) – 9th May 2023; KO Food Australia Pty LTD (from Korea) – 7th June 2023; Concordia Traders (Aust) Pty LTD (from China) 28th June 2023. Current food recalls (foodstandards.gov.au)
Australia (2023): K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx
Australia (2023): K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx
US (2022): Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022
US (2022): Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below).
Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains.
Europe (2022): Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/
Europe (2022): Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html
Europe (2022): Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)
Europe (2022): Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g.
Canada (2021): A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Canada (2021): CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*
A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below:
• USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness.
• USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2

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resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak.

- Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ.
- USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died.
- USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death.

Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms

In 2023, FSANZ coordinated an Australian national survey of imported and domestic enoki. The results indicate that 34/299 (11%) imported enoki samples were contaminated with *L. monocytogenes* at concentrations up to 11,000 CFU/g. The mean contamination level was 1,250 CFU/g. No detections of *L. monocytogenes* were observed in the 36 domestic samples.

Food Standards Agency and Food Standards Scotland issued an advisory notice in 2023 to vulnerable consumers to thoroughly cook enoki mushrooms following sampling data found the presence of *L. monocytogenes* in 13 of 40 (32.5%) samples tested, some of which were at high levels. Contaminated mushrooms were imported from China, Korea, Thailand and other Asian countries. (FSS and the FSA advise on Listeria monocytogenes in imported Enoki mushrooms | Food Standards Scotland)

The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China (having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023.

A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms.

These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines

Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia.

Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions:

> ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.
>
> ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.

Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions.

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Standards or guidelines
In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in these mushrooms. General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There is industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

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References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA Appendix 4- Bacterial pathogen growth and inactivation. https://www.fda.gov/media/80390/download Accessed August 2023.

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition Accessed August 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma . Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria* infections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

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14.11.2023

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: þ *Yes* ¨ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* can be present in enoki mushrooms and foodborne illness outbreaks have been associated with the consumption of enoki mushrooms, including in Australia • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • The different production and packaging conditions for imported enoki – lower temperatures during primary production and vacuum packaging - may provide a more conducive environment for *L. monocytogenes* growth • A cooking step such as boiling enoki mushroom should eliminate the hazard. However, there is evidence of consumption without adequate cooking. • Available evidence indicates that the prevalence and level of *L. monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the

Commented [s. 22(1)(a)Can the rationale include a point on vacuum packaging e.g. 'the different packaging and growth conditions for imported enoki – vacuum packaging and lower temperatures during primary production - may provide a more conducive environment for *L. monocytogenes* growth'. This may help us justify why risk management measures on the imported enoki are going to be different to domestic enoki.

Commented [s. 22(1)(a)(ii) Agree. Good comment.

Commented [s. 22(1)(a)(ii) "vacuum packed" enoki mushrooms are stated in the scope of the risk advice. So does it require clarity in the rationale?

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elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013). Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 CFU/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. Approximately 43% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 33% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly indicating that consumption of enoki mushrooms has increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than other sectors of the population. Those unfamiliar with enoki mushrooms may still consume them occasionally and may consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including from China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *L. monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (e.g. collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. To minimise contamination of enoki mushrooms with *L. monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017).

Commented [s. 22(1)(a)How does L. monocytogenes become 'established in the production environment'? Need a sentence or two before this one to explain how this could occur.

Commented [s. 22(1)(a)Is it possible to include some of the information provided by the US on potential sources of Lm contamination during growth and harvesting, such as the reuse of collars?

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L. monocytogenes is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki mushrooms stored at 5°C for 30 days with increasing growth rates at higher temperatures. Thus, if *L. monocytogenes* is present on the enoki mushrooms when packaged and the product has an extended shelf-life (> 14 days), it has the potential to grow to high numbers before consumption, even if refrigerated. Application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly. However, depending upon the initial contamination level, combined with longer storage times at temperatures of 5°C to ambient for both transport and storage, it is likely that the concentration of *Listeria* could increase to levels of 10^5-10^7 cells/g. This would constitute a public health and safety risk, particularly for vulnerable populations (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *L. monocytogenes* numbers occurring over a period of a month.

Consumer advice varies on the suitability of enoki mushrooms to be consumed raw. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). The US Mushroom Council states that enoki mushrooms can be consumed either eaten raw in salads or as part of a sandwich or can be used as an ingredient in soups and stocks (US Mushroom Council 2021). However, traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. As there is evidence these mushrooms are being used in non-traditional ways (e.g. salads, stir fries), they present an increased risk for listeriosis. To reduce any *L. monocytogenes* present to safe levels, the mushrooms need to be heated to at least 70°C for at least two minutes.

There are no specific measures reported for the control of *L. monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life.

Risk assessment by FSANZ to inform risk management

A risk assessment was undertaken by FSANZ to determine if a significant public health and safety risk is posed by *L. monocytogenes* and imported raw enoki mushrooms, and to provide scientific justification for risk management measures that can be applied to provide an appropriate level of risk for consumers. This also included consideration of applying a Performance Objective at the Australian border to achieve an appropriate level of risk. A Performance objective (PO) is defined as the maximum frequency and/or concentration of a hazard in a food at a specified step in the food chain before the time of consumption that provides or contributes to an appropriate level of risk.

The semi-quantitative risk assessment, estimated risk of illness to Australian consumers across a range of scenarios based on assumptions that all imported enoki:

- ~~all imported enoki~~ is refrigerated at 5°C post border
- ~~all imported enoki~~ has a storage time before consumption of between 14 and 55 days post border entry ~~and where is~~
- ~~all enoki~~ was ~~assumed~~ cooked before consumption, where cooking is 99% effective~~ness~~ (ie "usually eliminates the hazard") and ~~or~~
- ~~•~~ some were ~~enoki was assumed to be~~ consumed raw~~.~~

Across these scenarios, the ~~This~~ modelling also considered a range of potential levels of contamination at the border.

Best case scenario (i.e., with a lower storage time and effective cooking before consumption) estimated a medium to high risk of illness if 10% of imported enoki was contaminated at levels of 1,000 CFU/g where the serving size was 100g. This risk was increased where the scenario assumed ~~Additionally, a high risk was estimated if 15% of~~ imported enoki ~~was assumed~~ was to be consumed raw between 14 and 35 days post border entry. The outcomes of the risk assessment also demonstrated that:

- labelling is required to reduce risk but alone is insufficient to reduce the public health and safety risk posed by imported enoki under reasonably foreseeable conditions of use;
- enoki must be refrigerated through-chain once packaged, and must be labelled to be refrigerated and cooked thoroughly to reduce the risk of illness from this product;
- risk increases with a longer shelf-life. Food businesses should ensure that any and all date-marking are validated. Product at the Australian border with a remaining shelf-life datemarked >35 days should not be considered safe and suitable unless this can be ~~evidence~~ validated with provided evidencing ~~the date-marking can be provided. Additionally, food businesses should ensure that any and all date-marking are validated~~; and

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Commented [s. 22(1)(a)Considering other FSANZ risk advice does not include a section on 'Risk assessment by FSANZ to inform risk management' and doesn't go into detail on the methodology - and it's a given that all risk advice done by FSANZ involves risk assessment - can we condense this section by removing the first paragraph?

Commented [s. 22(1)(a)(ii) My thoughts - the reason FSANZ wouldn't usually have detail on a risk assessment here is because to change the Code, any new limits to Std 1.6.1 (and other standards) usually require a risk assessment that is published as part of the proposal process (for both public consultation and as a final version). For this, there is no limit and therefore no proposal and no published risk assessment - which I believe is why s. 22(1)(a asked for more detail. Happy to consolidate, but we need it in a transparent way somewhere that can be referred upon.

Commented [s. 22(1)(a)Did all scenarios assume Lm contamination?

Commented [s. 22(1)(a)(ii) Yes. Assumption of a 10% contamination prevalence (1000 cfu/g)

Commented [s. 22(1)(a)(ii)Reword based on the best - worst case scenarios

Commented [s. 22(1)(a)(ii) I have attempted to make changes to give an indication of best and worst case scenarios. Need to confirm that this generalised summary still accurately reflects the RA.

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Commented [s. 22(1)(a)(ii)Should this information be moved below i.e. was effective cooking vs non-effective cooking considered across the scenarios? Only retain assumptions here that applied across EVERY scenario and then ones that varied in point s. 22(1)(a)

Commented [MT13]: How can there still be a risk if the mushrooms are 'effectively cooked'? Or does the best case scenario just assume that some reduction has occurred from a cooking/heating step?

Commented [s. 22(1)(a)(ii) How I read the RA analysis was that the best case scenario = lowest risk rating. So that means there is a reduction from the cooking step.

Commented [s. 22(1)(a)(ii)Suggest being clear what the best case scenario was and the outcome. When the best case scenario was modelled, a medium to high risk of illness was found. In this best case scenario, enoki was refrigerated at 5 C or below, it underwent cooking before consumption etc.

Commented [s. 22(1)(a)(ii)Alternative wording: The risk assessment outcomes and the potentially hazardous nature of packaged enoki, indicate that product may not be considered safe and suitable if any of the following is true:

- There are no refrigeration instructions on packages for retail sale or accompanying bulk consignments.
- There are no cooking instructions on packages for retail sale or accompanying bulk consignments.

…

Commented [s. 22(1)(a)(ii)Labelling with what? This dot point needs clarifying.

Commented [s. 22(1)(a)(ii)Suggest re-wording to 'once packaged, through-chain refrigeration is required…'

Commented [s. 22(1)(a)(ii)Validated to demonstrate what …..? That the shelf life and stated refrigeration temperature keep levels to below 100 cfu/g?

Commented [s. 22(1)(a)(ii)As per above - validated to demonstrate …..

Commented [s. 22(1)(a)(ii)We are not sure of how this would work at the border Tania

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General description
• applying a PO of *L. monocytogenes* not detected in five 25g samples of enoki from a lot-, even if appropriate labelling is present, can contribute to reducing risk to an appropriate level. Enoki mushrooms can be considered a potentially hazardous food due to the potential presence of *L. monocytogenes* that can grow on this product during storage. Cooking time/temperatures required to achieve a 6D reduction of *L. monocytogenes* are 65°C for 9.3 minutes, 70°C for 2 minutes and 80°C and 85°C for 0.09 and 0.02 minutes respectively (FDA Guidelines). As such, it is also recommended to increase clarity of instructions for example labelling "Must be refrigerated below 5°C" and "Cook thoroughly at 70°C for at least 2 min". A through-chain risk management approach starting at primary production will be required to provide safe and suitable product, regardless of the storage instructions, and should also include environmental monitoring of *Listeria.*
Surveillance information: Listeriosis is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year). It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Canada (2021-2023):** • 16 September 2023: Golden Mushroom. Golden Mushroom brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca • 16th October 2023 Lian Teng. Lian Teng brand "Champignon Énoki" (Enoki Mushrooms) recalled due to Listeria monocytogenes - Canada.ca • 19th September 2023: Super brand. Super brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca • 28th July 2023: SSS brand. SSS brand Mushroom (enoki) recalled due to Listeria monocytogenes - Canada.ca • 15 May 2021: Ravine Mushroom Farms. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca • 7 May 2021: Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Australia (2023):** • 28th June 2023: Concordia Traders (Aust) Pty LTD. Concordia Traders Enoki Mushrooms (foodstandards.gov.au) • 27th June 2023: Natural Mushroom. Natural Mushrooms Enoki Mushrooms (foodstandards.gov.au) • 7th June 2023: KO Food Australia Pty LTD. KO Food Enoki Mushrooms (foodstandards.gov.au) • 2nd June 2023: Fruit Perfection Pty LTD. Fruit Perfections Enoki Mushrooms (foodstandards.gov.au) • 9th May 2023: Korea Connections. Korea Connections Enoki Mushrooms (foodstandards.gov.au) • 6th April 2023: K-mama https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx • 10th March 2023: K-mama https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** • 17th November 2022: Green Day Produce Ltd • 13th December 2022: Utopia Foods Note: FDA surveillance found many samples of enoki mushrooms were contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains. **Europe (2022):**

Commented [s. 22(1)(a)(ii)If removing first paragraph of this section as suggested, need to define 'PO' or use another descriptor with consideration of who the target audience of this publication is.

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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General description

- 13 May 2022: Ireland,: RASFF notification (2022.2633) Green Box Ltd Cendawan https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html
- 5 May 2022: Slovenia: RASFF notification (2022.2633) Green Box Ltd Cendawan Quantitative sampling detected levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/
- 25th March 2022: Netherlands: RASFF notification (2022.1779) Quantitative sampling detected levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)
- 15th February 2022: Netherlands: RASFF notification (2022.1776). Quantitative sampling detected levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. RASFF Window - Notification detail (europa.eu)

Illness associated with consumption of enoki mushrooms contaminated with *Listeria monocytogenes*

A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms.

USA (2016-2022):

- 2022: A recall of Utopia Foods Inc. of Glendale NY, November 2022 and expanded on 13 December 2022. As of 7 April 2023, 5 people infected and hospitalised were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada.
- 2020: As of 9 June 2020, 36 people were infected by *L. monocytogenes* from 17 states. 31 were hospitalised, 4 died and 2 foetal losses in 6 pregnancy-associated cases. Source identified as enokitake mushrooms supplied by Green Co. LTD.
- 2017: *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 ill patients, one died.
- 2016: multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 reported illnesses; 4 died.

Australia (2017-2020):

- 6 cases were notified between October 2017 and March 2020. Product was recalled on 10 April 2020. The strains were shown to be related to the USA outbreak strain via whole genome sequencing.

Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms

In 2023, FSANZ coordinated an Australian national survey of imported and domestic enoki. The results indicate that 34/299 (11%) imported enoki samples were contaminated with *L. monocytogenes* at concentrations up to 11,000 CFU/g. The mean contamination level was 1,250 CFU/g. No detections of *L. monocytogenes* were observed in the 36 domestic samples.

Food Standards Agency and Food Standards Scotland issued an advisory notice- in 2023 to vulnerable consumers to thoroughly cook enoki mushrooms following sampling data found the presence of *L. monocytogenes* in 13 of 40 (32.5%) samples tested. Contaminated mushrooms were imported from China, Korea, Thailand and other Asian countries. (FSS and the FSA advise on Listeria monocytogenes in imported Enoki mushrooms | Food Standards Scotland)

The US FDA's (2023) national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea and the People's Republic of China, showed 43% and 15% of the samples respectively were positive for *L. monocytogenes*.

A search of scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms; —3 from China and one from Spain. They indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines

Whole fruit and vegetables, including whole fungi, are exempt by definition from *L. monocytogenes* limits for ready-to-eat foods and labelling requirements of the Australia New Zealand Food Standards Code.

In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in enoki mushrooms.

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Standards or guidelines
General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There are industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). Currently, enoki is held until tests confirm *L. monocytogenes* is not detected in a lot. In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). Currently, to secure release of an individual shipment subject to detention without physical examination under this import alert, the owner, consignee, and/or other responsible party for the affected goods would provide evidence that the product does not bear or contain *L. monocytogenes*. The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

This draft risk statement was compiled in: November 2023

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References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA Appendix 4- Bacterial pathogen growth and inactivation. https://www.fda.gov/media/80390/download Accessed August 2023.

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition Accessed August 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma . Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria* infections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 27 April 2023 10:05 AM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii) Yang, Natasha; Barbara Butow
Subject: Draft risk statement for Enoki Mushrooms and Listeria monocytogenes attached [SEC=OFFICIAL]
Attachments: Lmono on enoki mushroom.docx

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Hi s. 22(1)(a)(ii)

Please find attached a draft risk statement for *Listeria monocytogenes* and enoki mushrooms for your consideration. I draw your attention to two comments in the document that I would appreciate comment on.

1. The scope of the statement was not agreed through the usual channels, so I have put something together in line with other statements. If you could check that the wording is appropriate for DAFF.
2. There is a lack of consumption data specifically for enoki mushrooms as opposed to general mushroom consumption which would be mainly button and portobello mushrooms and so I was wondering if it might be useful to consider import levels as a reflection of increasing use of enoki mushrooms. Would you be able to supply import data from 2010 to 2022?

I look forward to your comments in due course.

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: +s. 47F(1) | m: s. 47F(1)
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FOOD STANDARDS
Australia • New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Our values: DEVELOP • ACHIEVE • ACCOUNTABLE • RESPECT • TRANSPARENT

We acknowledge the Aboriginal and Torres Strait Islander peoples as First Peoples of Australia and Maori as tangata whenua of Aotearoa New Zealand

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14.11.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: þ *Yes* ¨ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* can be present in enoki mushrooms and foodborne illness outbreaks have been associated with the consumption of enoki mushrooms, including in Australia • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • A cooking step such as boiling enoki mushroom should eliminate the hazard. However, there is evidence of consumption without adequate cooking. • Available evidence indicates that the prevalence and level of *L. monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered

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General description
mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013). Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. Approximately 43% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 33% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly indicating that consumption of enoki mushrooms has increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than other sectors of the population. Those unfamiliar with enoki mushrooms may still consume them occasionally and may consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including from China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *L. monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (e.g. collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. To minimise contamination of enoki mushrooms with *L. monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). *L. monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C:

Commented [s. 22(1)(a)] Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

Commented [s. 22(1)(a)(ii)] I have moved the text. I am not aware of any specific routes of contamination by Listeria during production. It could well enter the premises on equipment or people depending on what PPE or sanitization at the entry to the facility is available. Once in the production space it would be difficult to eliminate or control particularly if you have not been completing environmental or product testing on site.

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1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki mushrooms stored at 5°C for 30 days with increasing growth rates at higher temperatures. Thus, if *L. monocytogenes* is present on the enoki mushrooms when packaged and the product has an extended shelf-life (> 14 days), it has the potential to grow to high numbers before consumption, even if refrigerated. Application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly. However, depending upon the initial contamination level, combined with longer storage times at temperatures of 5°C to ambient for both transport and storage, it is likely that the concentration of *Listeria* could increase to levels of 10^5-10^7 cells/g. This would constitute a public health and safety risk, particularly for vulnerable populations (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *L. monocytogenes* numbers occurring over a period of a month. Consumer advice varies on the suitability of enoki mushrooms to be consumed raw. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). The US Mushroom Council states that enoki mushrooms can be consumed either eaten raw in salads or as part of a sandwich or can be used as an ingredient in soups and stocks (US Mushroom Council 2021). However, traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. As there is evidence these mushrooms are being used in non-traditional ways (e.g. salads, stir fries), they present an increased risk for listeriosis. There are no specific measures reported for the control of *L. monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. **Risk assessment by FSANZ to inform risk management** A risk assessment was undertaken by FSANZ to determine if a significant public health and safety risk is posed by *L. monocytogenes* and imported raw enoki mushrooms, and to provide scientific justification for risk management measures that can be applied to provide an appropriate level of risk for consumers. This also included consideration of applying a Performance Objective at the Australian border to achieve an appropriate level of risk. A Performance objective (PO) is defined as the maximum frequency and/or concentration of a hazard in a food at a specified step in the food chain before the time of consumption that provides or contributes to an appropriate level of risk. The semi-quantitative risk assessment, estimated risk of illness to Australian consumers based on assumptions that: • all imported enoki is refrigerated at 5°C post border • has a storage time before consumption of between 14 and 55 days post border entry • is cooked before consumption, and • where cooking is 99% effectiveness (ie "usually eliminates the hazard"). This modelling estimated a medium to high risk of illness if 10% of imported enoki was contaminated at levels of 1,000 CFU/g where the serving size was 100g. Additionally, a high risk was estimated if 15% of imported enoki was assumed to be consumed raw between 14 and 35 days post border entry. The outcomes of the risk assessment also demonstrated that: • labelling is required to reduce risk but alone is insufficient to reduce the public health and safety risk posed by imported enoki under reasonably foreseeable conditions of use; • enoki must be refrigerated through-chain once packaged, and must be labelled to be refrigerated and cooked thoroughly to reduce the risk of illness from this product; • risk increases with a longer shelf-life. Product at the Australian border with a remaining shelf-life datemarked >35 days should not be considered safe and suitable unless evidence validating the date-marking can be provided. Additionally, food businesses should ensure that any and all date-marking are validated; and • applying a PO of *L. monocytogenes* not detected in five 25g samples of enoki from a lot , even if appropriate labelling is present, can contribute to reducing risk to an appropriate level. Enoki mushrooms can be considered a potentially hazardous food due to the potential presence of *L. monocytogenes* that can grow on this product during storage. Cooking time/temperatures required to achieve a 6D reduction of *L. monocytogenes* are 65°C for 9.3 minutes, 70°C for 2 minutes and 80°C and 85°C for 0.09 and 0.02 minutes respectively (FDA Guidelines). As such, it is also recommended to increase clarity of instructions for example labelling "Must be refrigerated below 5°C" and "Cook thoroughly at 70°C for at least 2 min". A through-chain risk management approach starting at primary production will be required to provide safe and suitable product, regardless of the storage instructions, and should also include environmental monitoring of *Listeria*.

Commented [s. 22(1)(a)What is considered to be 'extended shelf life'?

Commented [s. 22(1)(a)(ii) In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at s. 22(1)(a

Commented [HW5R3]: Rather than "used" in my comment I should have said "observed"

Commented [s. 22(1)(a)What level is constitutes a public health and safety risks?

Commented [s. 22(1)(a)(ii) Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if s. 22(1)(a lightly cooked or raw.

Commented [HW8R6]: For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a)(ii) So would indicate it poses a risk to vul pops, not the general pop, until there was another 10E2 increase?

Commented [s. 22(1)(a)(ii) Modified

Commented [s. 22(1)(a)(ii)I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these mushrooms raw or that they are being eaten this way?

Commented [s. 22(1)(a)(ii) Yes, the cited page is still on their website. I have amended the wording so it is as written on the web page

Commented [s. 22(1)(a)(ii)Alternative wording: The risk assessment outcomes and the potentially hazardous nature of packaged enoki, indicate that product may not be considered safe and suitable if any of the following is true:

- There are no refrigeration instructions on packages for retail sale or accompanying bulk consignments.
- There are no cooking instructions on packages for retail sale or accompanying bulk consignments.
- There are no date marks on packages for retail sale or accompanying bulk consignments.
- *L. monocytogenes* is detected in at least one of five 25g samples taken from a lot at point of entry at the Australian border, regardless of labelling.
- Product at the Australian border has a remaining shelf-life datemarked >35 days

Commented [s. 22(1)(a)(i)We are not sure of how this would work at the border s. 22(1)(a

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Surveillance information:

Listeriosis is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year). It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness.

Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)

Canada (2021-2023):

- 16 September 2023: Golden Mushroom. Golden Mushroom brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca
- 16th October 2023 Lian Teng. Lian Teng brand "Champignon Énoki" (Enoki Mushrooms) recalled due to Listeria monocytogenes - Canada.ca
- 19th September 2023: Super brand. Super brand Enoki Mushroom recalled due to Listeria monocytogenes - Canada.ca
- 28th July 2023: SSS brand. SSS brand Mushroom (enoki) recalled due to Listeria monocytogenes - Canada.ca
- 15 May 2021: Ravine Mushroom Farms. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
- 7 May 2021: Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca

Australia (2023):

- 28th June 2023: Concordia Traders (Aust) Pty LTD. Current food recalls (foodstandards.gov.au)
- 27th June 2023: Natural Mushroom. Current food recalls (foodstandards.gov.au)
- 7th June 2023: KO Food Australia Pty LTD. Current food recalls (foodstandards.gov.au)
- 2nd June 2023: Fruit Perfection Pty LTD. Current food recalls (foodstandards.gov.au)
- 9th May 2023: Korea Connections. Current food recalls (foodstandards.gov.au)
- 6th April 2023: K-mama https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx
- 10th March 2023: K-mama https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx

US (2022):

- 17th November 2022: Green Day Produce Ltd
- 13th December 2022**:** Utopia Foods

Note: FDA surveillance found many samples of enoki mushrooms were contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains.

Europe (2022):

- 13 May 2022: Ireland,: RASFF notification (2022.2633) Green Box Ltd Cendawan https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html
- 5 May 2022: Slovenia: RASFF notification (2022.2633) Green Box Ltd Cendawan Quantitative sampling detected levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/
- 25th March 2022: Netherlands: RASFF notification (2022.1779) Quantitative sampling detected levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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- 15th February 2022: Netherlands: RASFF notification (2022.1776). Quantitative sampling detected levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. RASFF Window - Notification detail (europa.eu)

Illness associated with consumption of enoki mushrooms contaminated with *Listeria monocytogenes*

A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms.

USA (2016-2022):

- 2022: A recall of Utopia Foods Inc. of Glendale NY, November 2022 and expanded on 13 December 2022. As of 7 April 2023, 5 people infected and hospitalised were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada.
- 2020: As of 9 June 2020, 36 people were infected by *L. monocytogenes* from 17 states. 31 were hospitalised, 4 died and 2 foetal losses in 6 pregnancy-associated cases. Source identified as enokitake mushrooms supplied by Green Co. LTD.
- 2017: *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 ill patients, one died.
- 2016: multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 reported illnesses; 4 died.

Australia (2017-2020):

- 6 cases were notified between October 2017 and March 2020. Product was recalled on 10 April 2020. The strains were shown to be related to the USA outbreak strain via whole genome sequencing.

Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms

In 2023, FSANZ coordinated an Australian national survey of imported and domestic enoki. The results indicate that 34/299 (11%) imported enoki samples were contaminated with *L. monocytogenes* at concentrations up to 11,000 CFU/g. The mean contamination level was 1,250 CFU/g. No detections of *L. monocytogenes* were observed in the 36 domestic samples.

Food Standards Agency and Food Standards Scotland issued an advisory notice in 2023 to vulnerable consumers to thoroughly cook enoki mushrooms following sampling data found the presence of *L. monocytogenes* in 13 of 40 (32.5%) samples tested. Contaminated mushrooms were imported from China, Korea, Thailand and other Asian countries. (FSS and the FSA advise on Listeria monocytogenes in imported Enoki mushrooms | Food Standards Scotland)

The US FDA's (2023) national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea and the People's Republic of China, showed 43% and 15% of the samples respectively were positive for *L. monocytogenes*.

A search of scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms; 3 from China and one from Spain. They indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines

Whole fruit and vegetables, including whole fungi, are exempt by definition from *L. monocytogenes* limits for ready-to-eat foods and labelling requirements of the Australia New Zealand Food Standards Code.

In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in enoki mushrooms.

General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020).

Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020).

Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017).

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Standards or guidelines
There are industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). Currently, enoki is held until tests confirm *L. monocytogenes* is not detected in a lot. In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). Currently, to secure release of an individual shipment subject to detention without physical examination under this import alert, the owner, consignee, and/or other responsible party for the affected goods would provide evidence that the product does not bear or contain *L. monocytogenes*. The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

This draft risk statement was compiled in: November 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA Appendix 4- Bacterial pathogen growth and inactivation. https://www.fda.gov/media/80390/download Accessed August 2023.

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition Accessed August 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma . Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

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FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Commented [s. 22(1)(a)(]: Please check that the wording of the scope is appropriate.

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* has caused foodborne illness associated with consumption of enoki mushrooms, which are considered to be an RTE food. • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • Australian prevalence data for *Listeria monocytogenes* and enoki mushrooms is limited at this time. Limited US and Canadian prevalence data is available for imported products .

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperature above 50°C is lethal to *Listeria*, but it can survive for long periods at temperatures below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions, and will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement are sterilised prior to use to remove any competing microorganisms. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *Listeria monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it is difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. *Listeria monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates of5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported significant growth of *L. monocytogenes* on enoki stored at 5°C for 30 days with increasing growth rates for increasing temperatures. . Thus, if *Listeria monocytogenes* is present on the enoki mushrooms when packaged, it has the potential to continue to grow to high numbers before consumption in product with extended shelf-life even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels that constitute a public health and safety risk (FSANZ unpublished. Cooler storage temperatures have been shown to control growth - Kim et al (2020) demonstrated no increase in *Listeria monocytogenes* numbers over a period of a month when stored at 1°C.

Commented [s. 22(1)(a)(i I realise that consumption trends for mushrooms has changed since this data was collected so I was wondering whether it might be possible to use the import numbers for enoki mushrooms from 2010 to 2022 to represent increasing consumer interest and purchasing over this period. I will also be following up with the team here who looks at current trends in food use in Australia.

General description
Enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). The Australian Mushroom Growers Association recommend that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). However, FSANZ notes that there is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food. Additionally, cross-contamination of other foods due to the preparation of enoki carrying high loads of *L. monocytogenes* presents an additional risk to consumers. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, cooked before consumption, and has an extended time before consumption of greater than 14 days predicted a significant high risk of illness if >1 CFU/g is present in the product. To ensure an appropriate level of risk for the Australian populat ion, *Listeria monocytogenes* should not be detectable in125g for these products (FSANZ unpublished)... There are no specific measures reported for the control of *Listeria* in enoki mushrooms although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023), it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life.
Surveillance information: *L. monocytogenes* is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Australia (2023):** K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx **Australia (2023)**: K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022 **US (2022):** Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below). Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains. **Europe (2022):** Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/ **Europe (2022):** Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html **Europe (2022):** Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)
[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

General description
of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)
Europe (2022): Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g.
Canada (2021): A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Canada (2021): CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*
A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below: • USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2 resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak. • Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ. • USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died. • USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death.
Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms
The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China (having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023.
A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms.
These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines

Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia.

Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions:

> ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.
>
> ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale:
>
> (a) remains in an intact package during its storage; and
>
> (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6.

Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions.

As part of the initial risk management response, the Department of Agriculture, Fisheries and Forestry (DAFF) has issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au)) to importers of enoki mushrooms.

General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020).

Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020).

Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017).

There are industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* apply to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.

Management approaches used by overseas countries

The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004).

Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Some products, such as Guatemalan raspberries, are associated with elevated food safety risks and have specific import requirements to minimize potential hazards (CFIA 2019a). Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under

Standards or guidelines
sanitary conditions (CFIA 2019b).Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023).
In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a).
The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products form being distributed in the US.

This draft risk statement was compiled in: April 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition. Accessed 23 May 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma. Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to chinahttps://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Tuesday, 14 November 2023 1:02 PM
To: s. 47F(1)
Cc: s. 22(1)(a)(ii) s. 47F(1)
Subject: Enoki Mushroom and Listeria risk documents [SEC=OFFICIAL:Sensitive]
Attachments: Imported Enoki FSANZ RA.docx; Revised draft statement Lmono on enoki mushroom_V2 14 11 2023.docx

Follow Up Flag: Follow up
Flag Status: Flagged

OFFICIAL: Sensitive

Hi s. 22(1)(a)(ii) s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

Following the discussion at last week's meeting, we have updated the risk statement - the Risk factors and Risk mitigation section (highlighted).
I have updated the list of international and domestic recalls etc of enoki as well.

Attached are the documents for your comment.

Also attached is the updated Risk Advice, just so you have both documents to hand as this supports the information in the risk statement.

Look forward to your feedback.

Regards
s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: +s. 47F(1) | m: s. 47F(1)
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FOOD STANDARDS Australia • New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Our values: DEVELOP • ACHIEVE • ACCOUNTABLE • RESPECT • TRANSPARENT
We acknowledge the Aboriginal and Torres Strait Islander peoples as First Peoples of Australia and Maori as tangata whenua of Aotearoa New Zealand

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29.06.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* has caused foodborne illness outbreaks associated with consumption of enoki mushrooms. • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • Available evidence indicates that the prevalence and level of *Listeria monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly suggesting that consumption of enoki mushrooms has also increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. To minimise contamination of enoki mushrooms with *Listeria monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *Listeria monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (eg collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. *Listeria monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki stored at 5°C for 30 days with increasing growth rates for increasing temperatures. Thus, if *Listeria monocytogenes* is present on the

Commented [s. 22(1)(a)Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

General description
enoki mushrooms when packaged and has an extended shelf-life (> 14 days), it has the potential to continue to grow to high numbers before consumption, even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels that constitute a public health and safety risk (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *Listeria monocytogenes* numbers occurring over a period of a month. ~~Enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). .~~ There is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). ~~. However, FSANZ notes that there is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food .~~ The US Mushroom Council states that enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). However, ~~T~~traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. ~~, however~~ As there is evidence that these mushrooms are increasingly being used in non-traditional ways (eg salads, stir fries), they present an increased risk ~~hence increasing the risk of~~ for listeriosis. If the producers of the mushrooms intend the mushrooms ~~As these mushrooms are intended~~ to be consumed cooked, appropriate cooking instructions should be provided on the packaging, as required in Standard 1.2.6 of the Code. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, cooked before consumption, and has an extended storage time before consumption of greater than 14 days predicted a significant high risk of illness if >1 CFU/g is present in the product. To ensure an appropriate level of risk for the Australian population, *Listeria monocytogenes* should not be detectable in a composite 125g sample (5x 25g) for these products (FSANZ unpublished). There are no specific measures reported for the control of *Listeria monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. Enoki mushrooms should be considered a potentially hazardous food due to the presence of *L. monocytogenes* that can grow on this product. Through-chain controls are needed during production, processing and post processing including refrigeration and thorough cooking before consumption. ~~, are required~~ to reduce the risk of illness from this product.
Surveillance information: *L. monocytogenes* is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Australia (2023):** K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx **Australia (2023)**: K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

Commented [s. 22(1)(a)What is considered to be 'extended shelf life'?

Commented [s. 22(1)(a)(ii) In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented [s. 22(1)(a)(ii) Rather than "used" in my comment I should have said "observed"

Commented [s. 22(1)(a)What level is constitutes a public health and safety risks?

Commented [s. 22(1)(a)(ii) Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented [s. 22(1)(a)(ii) For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a)Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii) Added a sentence to cover this

Commented [s. 22(1)(a)(ii)Need to include additional text to explain that in ethnic groups that use these mushrooms in traditional cooking, the mushrooms are boiled before being cooked. However, these mushrooms are increasingly being used in non-traditional ways such as in salads, stir fries etc. This creates additional risks. We also need to explain that if these mushrooms are not intended to be eaten without thorough cooking, then the Code requires these instructions to be included. This isn't occurring and in any case, places a lot of responsibility on the consumer to ensure the safety of the food before it is eaten.

Commented [s. 22(1)(a)(ii) I have added some wording around this - see highlighted in yellow

Commented [s. 22(1)(a)(ii)Need to include additional text to explain that in ethnic groups that use these mushrooms in traditional cooking, the mushrooms are boiled before being cooked. However, these mushrooms are increasingly being used in non-traditional ways such as in salads, stir fries etc. This creates additional risks. We also need to explain that if ...

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Commented [s. 22(1)(a)(ii)Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii) Added a sentence to cover this

Commented [s. 22(1)(a)(ii)I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these ...

Commented [s. 22(1)(a)(ii)Or regardless of the intention of the producer in relation to end use, are we saying that all enoki ...

Commented [s. 22(1)(a)(ii)Do you mean not cooked or not sufficiently cooked before consumption?

Commented [s. 22(1)(a)(ii) No this was modelled for cooked enoki

Commented [s. 22(1)(a)(ii)This para needs strengthening to explain the risk with eating enoki raw, lightly cooked and full ...

Commented [s. 22(1)(a)(ii)Can we be clear here that this advice stands whether or not the product includes storage instructio ...

Commented [s. 22(1)(a)(ii)Apart from thoroughly cooking before consuming!

Commented [s. 22(1)(a)(ii)Anything on storage of enoki?

Commented [s. 22(1)(a)(ii) Only that they should be stored at refrigeration temperatures. It has been difficult to determine ...

Commented [s. 22(1)(a)(ii)Suggest this para should proceed the one above.

General description
US (2022): Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below). Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains. **Europe (2022):** Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/ **Europe (2022):** Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html **Europe (2022):** Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu) **Europe (2022):** Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. **Canada (2021):** A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Canada (2021):** CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*** A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below: • USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2 resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak. • Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ. • USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died. • USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death. **Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms** The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China

General description
(having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023. A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms. These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines
Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia. Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions: ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions. In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in these mushrooms. General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There is industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be “primary food production”). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries

Standards or guidelines
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

Commented [s. 22(1)(a)(i)Any information on NZ?

Commented [s. 22(1)(a)(ii) I have asked and at this point in time MPI is not doing anything specific for enoki. I am not sure how much is being imported but as far as I am aware there have not been any cases reported that have been linked to enoki mushrooms.

Commented [s. 22(1)(a)(ii)What do these alerts say? Are these products banned from being imported?

Commented [s. 22(1)(a)(ii) No they are not banned. It is only to prevent contaminated product entering the US, and so any suspect product can be detained without inspection. I have expanded this by including a quote from the Import Alert.

This draft risk statement was compiled in: June 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition. Accessed 23 May 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma. Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Friday, 21 July 2023 2:56 PM
To: s. 47F(1)
Cc: s. 22(1)(a)(ii) s. 47F(1)
Subject: FEEDBACK: Enoki mushrooms revised draft risk statements attached [SEC=OFFICIAL]
Attachments: Revised advice Lmono on enoki mushroom DAFF comments 2.docx

Good afternoon s. 47F(1)

Please find IF (DAFF) feedback in the attached revised risk advice (Enoki mushrooms and *L. monocytogenes*).

We wanted to flag with you the following:

- This risk advice requires to state the Listeria testing limits – either 'nil tolerance' or the limit that is allowable based on shelf life of the enoki mushrooms.
  This will greatly aid in implementing our risk management strategy (Listeria testing) at the border.

- We would request to review another draft of this risk advice please once you have gone through our suggested changes.

Thank you once again for providing us this risk advice.

If you have any further queries, do get in touch.
Have a lovely weekend
Kind regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Thursday, June 29, 2023 1:05 PM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) foodstandards.gov.au>
Subject: RE: RTE Dates draft risk statements attached [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached the revised draft version of the Listeria monocytogenes and Enoki mushrooms risk statement for your second review.

I have addressed all the comments either by making changes in the text (highlighted in yellow) or by responding to the comment or both. I have also accepted all the suggested changes made in the text. I have highlighted all the main changes that I have made, noting that there are a few places where I have made a grammatical or minor change that I noted when reading.

Also note that I have not added any of the information from the enoki mushroom survey at this time. It may be possible to include this before publication, but I wanted to keep moving forward with the risk statement

in the meantime. It is unlikely that the results from the survey will make a substantive difference to this risk statement.

If you have any questions let me know, otherwise I look forward to receiving your comments in due course.

Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

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We acknowledge the Aboriginal and Torres Strait Islander peoples as First Peoples of Australia and Maori as tangata whenua of Aotearoa New Zealand

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29.06.2023

FOOD STANDARDS Australia New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Recommendation and rationale
Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is strong evidence that *L. monocytogenes* has caused foodborne illness outbreaks associated with consumption of enoki mushrooms. • The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur. • Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures. • Available evidence indicates that the prevalence and level of *Listeria monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

General description
Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).
Consumption patterns: Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set. 43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms. Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms. Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly suggesting that consumption of enoki mushrooms has also increased over this time. Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.
Risk factors and risk mitigation: Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock. Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. To minimise contamination of enoki mushrooms with *Listeria monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017). Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *Listeria monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (eg collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination. *Listeria monocytogenes* is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki stored at 5°C for 30 days with increasing growth rates for increasing temperatures. Thus, if *Listeria monocytogenes* is present on the

Commented [s. 22(1)(a)Suggest moving the new text so that it follows the para below as the para below is also about contamination. Also is there any information on the sources of contamination?

General description
enoki mushrooms when packaged and has an extended shelf-life (> 14 days), it has the potential to continue to grow to high numbers before consumption, even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels that constitute a public health and safety risk (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *Listeria monocytogenes* numbers occurring over a period of a month. ~~Enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). .~~ There is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food. The Australian Mushroom Growers Association recommends that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). ~~. However, FSANZ notes that there is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food .~~ The US Mushroom Council states that enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). However, ~~T~~traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption. ~~, however~~ As there is evidence that these mushrooms are increasingly being used in non-traditional ways (eg salads, stir fries), they present an increased risk ~~hence increasing the risk of~~ for listeriosis. If the producers of the mushrooms intend the mushrooms ~~As these mushrooms are intended~~ to be consumed cooked, appropriate cooking instructions should be provided on the packaging, as required in Standard 1.2.6 of the Code. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, cooked before consumption, and has an extended storage time before consumption of greater than 14 days predicted a significant high risk of illness if >1 CFU/g is present in the product. To ensure an appropriate level of risk for the Australian population, *Listeria monocytogenes* should not be detectable in a composite 125g sample (5x 25g) for these products (FSANZ unpublished). There are no specific measures reported for the control of *Listeria monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. Enoki mushrooms should be considered a potentially hazardous food due to the presence of *L. monocytogenes* that can grow on this product. Through-chain controls are needed during production, processing and post processing including refrigeration and thorough cooking before consumption. ~~, are required~~ to reduce the risk of illness from this product.
Surveillance information: *L. monocytogenes* is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Australia (2023):** K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx **Australia (2023)**: K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

Commented [s. 22(1)(a)What is considered to be 'extended shelf life'?

Commented [s. 22(1)(a)(ii) In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented [s. 22(1)(a)(ii) Rather than "used" in my comment I should have said "observed"

Commented [s. 22(1)(a)What level is constitutes a public health and safety risks?

Commented [s. 22(1)(a)(ii) Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented [s. 22(1)(a)(ii) For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a)Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii) Added a sentence to cover this

Commented [s. 22(1)(a)(ii)Need to include additional text to explain that in ethnic groups that use these mushrooms in traditional cooking, the mushrooms are boiled before being cooked. However, these mushrooms are increasingly being used in non-traditional ways such as in salads, stir fries etc. This creates additional risks. We also need to explain that if these mushrooms are not intended to be eaten without thorough cooking, then the Code requires these instructions to be included. This isn't occurring and in any case, places a lot of responsibility on the consumer to ensure the safety of the food before it is eaten.

Commented [s. 22(1)(a)(ii) I have added some wording around this - see highlighted in yellow

Commented [s. 22(1)(a)(ii)Need to include additional text to explain that in ethnic groups that use these mushrooms in traditional cooking, the mushrooms are boiled before being cooked. However, these mushrooms are increasingly being used in non-traditional ways such as in salads, stir fries etc. This creates additional risks. We also need to explain that if ...

Commented [s. 22(1)(a)(ii) I have added some wording around this - see highlighted in yellow

Commented [s. 22(1)(a)(ii)Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii) Added a sentence to cover this

Commented [s. 22(1)(a)(ii)I've reworded this but is it still correct? Is the US Mushroom Council saying that you can eat these ...

Commented [s. 22(1)(a)(ii)Or regardless of the intention of the producer in relation to end use, are we saying that all enoki ...

Commented [s. 22(1)(a)(ii)Do you mean not cooked or not sufficiently cooked before consumption?

Commented [s. 22(1)(a)(ii) No this was modelled for cooked enoki

Commented [s. 22(1)(a)(ii)This para needs strengthening to explain the risk with eating enoki raw, lightly cooked and full ...

Commented [s. 22(1)(a)(ii)Can we be clear here that this advice stands whether or not the product includes storage instructio ...

Commented [s. 22(1)(a)(ii)Apart from thoroughly cooking before consuming!

Commented [s. 22(1)(a)(ii)Anything on storage of enoki?

Commented [s. 22(1)(a)(ii) Only that they should be stored at refrigeration temperatures. It has been difficult to determine ...

Commented [s. 22(1)(a)(ii)Suggest this para should proceed the one above.

General description
US (2022): Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below). Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains. **Europe (2022):** Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/ **Europe (2022):** Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html **Europe (2022):** Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu) **Europe (2022):** Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g. **Canada (2021):** A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Canada (2021):** CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca **Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*** A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below: • USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2 resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak. • Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ. • USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died. • USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death. **Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms** The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China

General description
(having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023. A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms. These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from 4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines
Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia. Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions: ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions. In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in these mushrooms. General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There is industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be “primary food production”). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries

Standards or guidelines
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004). Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

This draft risk statement was compiled in: June 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Commented [s. 22(1)(a)(i)Any information on NZ?

Commented [s. 22(1)(a)(ii) I have asked and at this point in time MPI is not doing anything specific for enoki. I am not sure how much is being imported but as far as I am aware there have not been any cases reported that have been linked to enoki mushrooms.

Commented [s. 22(1)(a)(i)What do these alerts say? Are these products banned from being imported?

Commented [s. 22(1)(a)(ii) No they are not banned. It is only to prevent contaminated product entering the US, and so any suspect product can be detained without inspection. I have expanded this by including a quote from the Import Alert.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition. Accessed 23 May 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma. Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria i*nfections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Thursday, 29 June 2023 1:05 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii) s. 47F(1)
Subject: RE: RTE Dates draft risk statements attached [SEC=OFFICIAL]
Attachments: Lmono on enoki mushroom DAFF comments2.docx

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached the revised draft version of the Listeria monocytogenes and Enoki mushrooms risk statement for your second review.

I have addressed all the comments either by making changes in the text (highlighted in yellow) or by responding to the comment or both. I have also accepted all the suggested changes made in the text. I have highlighted all the main changes that I have made, noting that there are a few places where I have made a grammatical or minor change that I noted when reading.

Also note that I have not added any of the information from the enoki mushroom survey at this time. It may be possible to include this before publication, but I wanted to keep moving forward with the risk statement in the meantime. It is unlikely that the results from the survey will make a substantive difference to this risk statement.

If you have any questions let me know, otherwise I look forward to receiving your comments in due course.

Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: +s. 47F(1) | m: s. 47F(1)

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, June 26, 2023 2:13 PM
To: s. 47F(1) @foodstandards.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: RTE Dates draft risk statements attached [SEC=OFFICIAL]

Good afternoon s. 47F(1)

Please find attached the revised draft for Dates and HepA.
Thank you for making the edits and addressing our queries. We are happy with the changes. The attached draft has only one minor edit.

We also want to take this opportunity to ask if you have any update of the enoki mushrooms and Listeria advice?

Thank you
Kind regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Monday, May 29, 2023 10:08 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: RTE Dates draft risk statements attached [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached the revised Dates and HepA risk statement for your comment. Please note that I have accepted your edits and addressed your queries either in the comments and/or made changes to the text (highlighted in yellow)

If you have any additional comments, please let me so that I can get this document finalised and start the clearance process.

Best Regards

s. 47F(1)

From: s. 47F(1)
Sent: Monday, 1 May 2023 2:01 pm
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: RTE Dates draft risk statements attached [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Thanks for sending through your comments, I will work through them and then send you a revised version to see if you are happy with the changes I have made.

Please note that soon my email address will be changing to s. 47F(1) @foodstandards.gov.au . As I understand it the old email will continue to be active for a transition period to the new address to ensure we do not lose contact with our stakeholders.

Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: +s. 47F(1)
e: s. 47F(1) foodstandards.govt.nz

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 1 May 2023 1:42 pm
To: s. 47F(1) s@foodstandards.govt.nz>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: RTE Dates draft risk statements attached [SEC=OFFICIAL]

Good morning s. 47F(1)

Our apologies for the delay with reviewing this risk advice.

Please find attached our review/ comments for the DRAFT risk advice for RTE Dates and Hep A. We did not review the risk statement regarding Dates and Salmonella as it was assessed as low risk.

Regarding the HepA advice, we are concerned about use of term ‘date products’ and think the risk mitigation section needs to be clearer about whether there is any difference in risk between all the different ‘dates’ in scope of the advice. For example, fresh vs dried. It would also be helpful if date products were defined and a discussion included on whether any of these products have a lower Hep A risk, for example so may include heat processing.

Looking forward to hearing from you.

Kind regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Tuesday, 11 April 2023 9:58 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Subject: RTE Dates draft risk statements attached [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached the draft risk statements for RTE Dates and Hepatitis A and Salmonella for your review and comments.

The risk evaluation for Dates and Hepatitis A is “High Risk” while that for Salmonella is “Low Risk”.

If you have any questions concerning the statements please let me know, otherwise I look forward to receiving your comments in due course.

Regards

s. 47F(1)

s. 47F(1)

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OFFICIAL

29.06.2023

FOOD STANDARDS Australia New Zealand
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Imported food risk statement

Enoki (enokitake) mushrooms and *Listeria monocytogenes*

Scope: Enoki (enokitake) mushrooms, or golden needle mushrooms - fresh packaged (including vacuum packed, but not canned, dried or frozen enoki mushrooms)

Commented [s. 22(1)(a)(i) Please check that the wording of the scope is appropriate.

Commented [s. 22(1)(a)(ii) Can we use the term "not ready-to-eat (NRTE)" with enoki mushrooms for clarity? Is it feasible? https://www.cabdirect.org/cabdirect/abstract/20093136032

Commented [s. 22(1)(a)(ii) In the scope, we don't want to refer to NRTE as it doesn't matter whether the mushrooms are ready to eat or not as both present a medium to high risk to public health. However, in the advice it should be clear that both are included and why.

Commented [s. 22(1)(a)(ii) Will leave as written now

Recommendation and rationale

Does *Listeria monocytogenes* in imported enoki mushrooms present a potential medium or high risk to public health:

☑ *Yes*

☐ *No*

Rationale:

- *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%.
- There is strong evidence that *L. monocytogenes* has caused foodborne illness outbreaks associated with consumption of enoki mushrooms.
- The method of production and processing can introduce microbial contamination. There is also the potential for post-processing contamination to occur.
- Growth of *L. monocytogenes* can occur on enoki mushrooms, including when stored at refrigeration temperatures.
- Available evidence indicates that the prevalence and level of *Listeria monocytogenes* in enoki mushrooms is sufficient to be a public health risk.

General description

Nature of the microorganism:

Listeria monocytogenes is a Gram-positive, non-spore forming rod-shaped, facultative anaerobic bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013).

L. monocytogenes is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal growth temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to *Listeria*, but it can survive for long periods at refrigeration temperatures and below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions and it will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).

Adverse health effects:

For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, neonates, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013).

In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

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Published data indicate that contaminated foods responsible for foodborne listeriosis usually contain levels of *L. monocytogenes* >100 cfu/g (Ryser and Buchanan 2013). Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection (FSANZ 2013).

Consumption patterns:

Data from 2011–12 Australian National Nutrition and Physical Activity Survey (ABS, 2014) is used to determine consumption patterns for specific foods. Enoki mushrooms are not listed as a specific food so it is not possible to separate out that consumption data from the collective "All mushrooms" data set.

43.2% of adults (aged over 17 years) reported consuming mushrooms either raw or cooked while 32.7% of children (16 years and younger) reported eating mushrooms. In both groups, the majority of respondents consumed cooked or heat-treated mushrooms.

Less than 0.1% of respondents specifically reported consuming "oriental mushrooms", a food classification that included shiitake, enoki, oyster, chestnut, shimeji and wood ear mushrooms.

Imports of enoki mushrooms have been steadily increasing year-on-year (2010: 169,000 kg; 2022: 2.23 million kg) strongly suggesting that consumption of enoki mushrooms has also increased over this time.

Enoki mushrooms have been cultivated for hundreds of years and are often used in Chinese, Japanese, and Korean cuisine. Thus, people of Asian heritage are more likely to consume enoki mushrooms more often than non-Asians, although non-Asians could reasonably consume enoki mushrooms occasionally and may even consume them raw.

Risk factors and risk mitigation:

Enoki mushrooms, *Flammulina filiformis,* (formerly known as *Flammulina velutipes*) is a member of the gilled mushroom family, Physalacriaceae. These mushrooms, also known as golden needle or enokitake, are commonly used in East Asian cuisine including China, Japan, Korea and Vietnam. *Flammulina filiformis*, when grown naturally are golden brown, loosely clustered with a relatively short stipe, unlike those produced commercially which are white capped (pileus), with a long slender stipe which are harvested clumped together on a single root stock.

Commercial production of enoki uses open topped jars (e.g. mason jars) with a lignin-cellulose based medium (hard wood, sawdust or wheat straw) with the addition of a wheat or rice bran (or similar) nitrogen supplement. Both the jars and the medium including the supplement should be sterilised prior to use to remove any microorganisms that would compete with enoki spawn. Water and spawn (spore seeding) are added to the medium in the jars which are capped to retain the high humidity (50-80% moisture content with a slightly acidic pH) and a higher concentration of CO_2 which is required for spore germination and initial stipe development. Once the stipe and pileus is close to the top of the jar, a disposable collar is placed around the neck of the jar to promote long straight stipe growth. Harvest occurs once growth has reached the top of the collar, which is then removed and the enoki mushrooms are pulled out of the jar, including the "root stock" and packaged into polypropylene (PP) or similar bags with either a partial or full vacuum applied. Although some parts of this process are mechanised, (mainly the racking of jars to trays, stacking of the trays and movement to and from culture rooms; packaging) collaring and harvesting are still performed by hand. To minimise contamination of enoki mushrooms with *Listeria monocytogenes*, effective control measures are necessary during primary production and processing, e.g. through application of Good Manufacturing Practices (GMP) on-farm and Good Hygienic Practices (GHP) at critical points in the supply chain (Codex 2017).

Production of enoki mushrooms requires high humidity (50-80%), water added to the growth matrix, relatively high CO_2 concentrations of 0.3-0.5% during initial mycelial growth reducing to 0.1-0.2% during stipe elongation and pileus formation and ambient temperatures (3-34°C with an optimum of 18-25°C) to ensure rapid growth (reviewed in Dowom et al, 2019). This also creates an ideal environment for pathogenic *Listeria* spp. to grow and persist. Once *Listeria monocytogenes* is established in the production environment, given the nature of the enoki growth requirements, it will be difficult to eliminate and may remain a potential source for ongoing contamination of the enoki mushrooms during growth and harvest. Any additional handling (eg collaring) of the enoki mushrooms during the growth phase will increase the risk of production contamination.

Listeria monocytogenes is able to grow on enoki mushrooms, both whole and cut, with elevated growth rates associated with increasing temperatures. For example, Fay et al. 2023 reported growth rates at 5°C: -0.02±0.03; 10°C: 0.28±0.03; 25°C: 1.32±0.12 log CFU/g per day for storage up to 7 days. Kim et al (2020) reported growth of *L. monocytogenes* on enoki stored at 5°C for 30 days with increasing growth rates for increasing temperatures. Thus, if *Listeria monocytogenes* is present on the

Commented [s. 22(1)(a)(ii) I realise that consumption trends for mushrooms has changed since this data was collected so I was wondering whether it might be possible to use the import numbers for enoki mushrooms from 2010 to 2022 to represent increasing consumer interest and purchasing over this period. I will also be following up with the team here who looks at current trends in food use in Australia.

Commented [s. 22(1)(a)(ii) Import data fresh enoki mushrooms (2010-2022) sent 2 May 2023

Commented [s. 22(1)(a)(ii) Agree that is would be useful to include import data, particularly upwards trend with volumes of imports - assuming that is the case!

Commented [s. 22(1)(a)(ii) I have added in import data.

Commented [s. 22(1)(a)(ii) 'Good food safety practices' should be made clearer.

Commented [s. 22(1)(a)(ii) I have added this point into the text. Highlighted in yellow

Commented [s. 22(1)(a)(ii) What is considered 'significant growth'?

Commented [s. 22(1)(a)(ii) Removed the "significant" from the statement. Key message here is that it can grow on enoki at refrigeration temperatures.

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enoki mushrooms when packaged and has an extended shelf-life (> 14 days), it has the potential to continue to grow to high numbers before consumption even if refrigerated. Although application of a partial vacuum and the continued respiration by enoki mushrooms may slow the growth rate slightly - depending upon the initial contamination level, given the longer storage time and potential use of 5°C to ambient temperatures for transport and storage, it is likely that the concentration of *Listeria* could increase to levels that constitute a public health and safety risk (FSANZ unpublished). Cooler storage temperatures (less than or equal to 1°C) have been shown to control growth - Kim et al (2020), with no increase in *Listeria monocytogenes* numbers occurring over a period of a month. Enoki mushrooms can be consumed either following light cooking or eaten raw, generally as a garnish or as part of a sandwich (US Mushroom Council 2021). The Australian Mushroom Growers Association recommend that enoki are not consumed raw but instead undergo light cooking (AMGA 2023). However, FSANZ notes that there is conflicting consumer advice regarding the suitability of enoki mushrooms to be consumed as a RTE food. Traditional preparation of enoki mushrooms involves boiling or thoroughly heating before consumption, however these mushrooms are increasingly being used in non-traditional ways (eg salads, stir fries), hence increasing the risk of listeriosis. As these mushrooms are intended to be consumed cooked, appropriate cooking instructions should be provided on the packaging. Modelling risk of illness to Australian consumers based on the assumptions that all imported enoki is refrigerated at 5°C, cooked before consumption, and has an extended storage time before consumption of greater than 14 days predicted a significant high risk of illness if >1 CFU/g is present in the product. To ensure an appropriate level of risk for the Australian population, *Listeria monocytogenes* should not be detectable in a composite 125g sample (5x 25g) for these products (FSANZ unpublished). There are no specific measures reported for the control of *Listeria monocytogenes* in enoki mushrooms during production, although a number of wash water additives have been proposed that could be applied at food service or at the household level (Chung et al 2023). However, it is unclear if these would be effective in reducing level of *Listeria* contamination sufficiently during processing to minimise the risk to consumers particularly at the end of product shelf life. Enoki mushrooms should be considered a potentially hazardous food due to the presence of *L. monocytogenes* that can grow on this product. Through-chain refrigeration and thorough cooking before consumption are required to reduce the risk of illness from this product.
Surveillance information: *L. monocytogenes* is a notifiable disease in all Australian states and territories. In 2022 the reported incidence rate was 0.3 cases per 100,000 population (88 cases), this includes both foodborne and non-foodborne cases[1]. The foodborne rate is estimated to be 98% (90% CrI 90-100%) for *L. monocytogenes* cases in Australia (Kirk et al. 2014). The previous five year mean reported incidence rate was 0.3 cases per 100,000 population per year (ranging from 0.2–0.4 cases per 100,000 population per year)[2]. It is not anticipated that the global coronavirus disease pandemic had a significant impact on the number of listeriosis cases reported in 2021, as listeriosis is not generally a travel-associated illness and people would still seek medical care due to the severity of the illness. **Enoki mushroom recalls due to detection of *Listeria monocytogenes* (no known illnesses reported)** **Australia (2023):** K-mama enoki mushroom from Republic of South Korea were recalled on 6th April 2023 https://www.foodstandards.gov.au/industry/foodrecalls/recalls/Pages/K-mama-Enoki-Mushrooms-300g.aspx **Australia (2023)**: K-mama enoki mushrooms from Republic of South Korea were recalled on 10th March 2023. https://www.foodstandards.gov.au/consumer/generalissues/Pages/Listeria-Monocytogenes-linked-to-fresh-enoki-mushrooms-imported-from-South-Korea.aspx **US (2022):** Green Day Produce enoki mushrooms from People's Republic of China were recalled on 17th November 2022 **US (2022):** Utopia Foods initiated a recall on 13th December 2022 when *Listeria* was detected. This strain was not the same as the outbreak strain (see below). Note that as part of the FDA surveillance many samples of enoki mushrooms were found to be contaminated with various strains of *Listeria* most of which were not the same as the outbreak strains.

[1] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)
[2] Data on the number of listeriosis cases provided by the National Interoperable Notifiable Disease Surveillance System with population data from the Australian Bureau of Statistics (accessed 11 January 2023)

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Commented [s. 22(1)(a)(ii)**]** What is considered to be 'extended shelf life'?

Commented [s. 22(1)(a)(ii)**]** In the risk advice we defined a storage time of 14 days with 1-3 months being an extended period, noting that this these periods of time have been used on products at retail.

Commented [s. 22(1)(a)(ii)**]** Rather than "used" in my comment I should have said "observed"

Commented [s. 22(1)(a)(ii)**]** What level is constitutes a public health and safety risks?

Commented [s. 22(1)(a)(ii)**]** Aligned with estimated infectious dose of 10E5 to 10E7 cells for vulnerable persons. I can add this in if you feel it is important information but as noted in the advice document if the level detected in food was 0-100cfu initially, then the level at the end of shelf life would be at the risk level if eaten lightly cooked or raw.

Commented [s. 22(1)(a)(ii)**]** For healthy adults the infectious dose can be as high as 10E9 cells

Commented [s. 22(1)(a)(ii)**]** Need to include text to acknowledge that traditional use is to boil the mushrooms before eating!

Commented [s. 22(1)(a)(ii)**]** Added a sentence to cover this

Commented [s. 22(1)(a)(ii)**]** Need to include additional text to explain that in ethnic groups that use these mushrooms in traditional cooking, the mushrooms are boiled before being cooked. However, these mushrooms are increasingly being used in non-traditional ways such as in salads, stir fries etc. This creates additional risks. We also need to explain that if these mushrooms are not intended to be eaten without thorough cooking, then the Code requires these instructions to be included. This isn't occurring and in any case, places a lot of responsibility on the consumer to ensure the safety of the food before it is eaten.

Commented [s. 22(1)(a)(ii)**]** I have added some wording around this - see highlighted in yellow

Commented [s. 22(1)(a)(ii)**]** All consumers or just at risk consumers?

Commented [s. 22(1)(a)(ii)**]** Applies to all consumers

Commented [s. 22(1)(a)(ii)**]** Do you mean not cooked or not sufficiently cooked before consumption?

Commented [s. 22(1)(a)(ii)**]** No this was modelled for cooked enoki

Commented [s. 22(1)(a)(ii)**]** Apart from thoroughly cooking before consuming!

Commented [s. 22(1)(a)(ii)**]** Anything on storage of enoki?

Commented [s. 22(1)(a)(ii)**]** Only that they should be stored at refrigeration temperatures. It has been difficult to determine what type of packaging is used for imported enoki mushrooms, particular for those that are imported in to Australia and then re-packaged for sale. Pre-packaged product may well have a partial vaccum or MAP applied but this is unclear so the only recommendation is that the product is stored at 5C. I believe this is clear in the document but if you would like additional statement added I can do this.

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Europe (2022): Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (Slovenia) placed a RASFF notification (2022.2633) for the presence of *Listeria monocytogenes* in Green Box Ltd Cendawan enoki mushrooms originating from China on 5th May 2022 and a customer recall was implemented. Quantitative sampling carried out on 22nd April 2022 revealed levels of 2.6x 10^5 CFU/g (allowable maximum limit is <100 CFU/g). https://webgate.ec.europa.eu/rasff-window/screen/notification/547886 ; https://www.gov.si/novice/2022-05-05-odpoklic-enoki-gob-zaradi-ugotovljene-prisotnosti-bakterije-listeria-monocytogenes/
Europe (2022): Ireland also issued a recall notice on 13 May 2022 for Green Box Ltd Cendawan Enoki Mushrooms (China). This was part of a series of investigations and measures taken across EU (RASFF notification (2022.2633). https://www.fsai.ie/news_centre/food_alerts/recall_cendawan_enoki_mushroom.html
Europe (2022): Netherlands placed a RASFF notification (2022.1779) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from China, on 25th March 2022. Results of quantitative sampling on 3rd February 2022 revealed levels of 1.4 x 10^2 - <20 CFU/g and 7.6 x 10^3 - 1.3 x 10^3 CFU/g (allowable maximum limit is <100 CFU/g). RASFF Window - Notification detail (europa.eu)
Europe (2022): Netherlands placed a RASFF notification (2022.1776) for the presence of *Listeria monocytogenes* in enoki mushrooms originating from Republic of South Korea. This was an information notification. Quantification of samples (15th February 2022) showed levels of 1.6 x 10^4 - 1.2 x 10^2 CFU/g and 3.2 x 10^2 - 5.0 x 10^5 CFU/g.
Canada (2021): A recall was issued by the Canadian Food Inspection Agency (CFIA) for enoki mushrooms distributed by Ravine Mushroom Farms on 15th May 2021. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Canada (2021): CFIA issued a recall on 7th May 2021 for enoki mushrooms due to *Listeria monocytogenes* detection which were distributed by Goldenway International Trade Co. Certain Enoki Mushrooms may be unsafe due to Listeria monocytogenes - Canada.ca
Illness associated with consumption of enoki mushrooms sold contaminated with *Listeria monocytogenes*
A search of the scientific literature from 2000 to 2023 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified 5 listeriosis outbreaks associated with consumption of enokitake mushrooms, 4 of which occurred in the USA. They are listed below: • USA (2022): Investigation ended. As of April 7th 2023, 5 people infected and hospitalised by *L. monocytogenes* in enokitake mushrooms were reported from 4 states, 2 persons from California, and 1 each from New Jersey, Michigan and Nevada. A recall of enokitake mushrooms related to a specific brand name, Utopia Foods Inc. of Glendale NY, was initiated in late November 2022 and expanded on 13th December 2022 as the first time a specific brand was linked to illness. • USA (2020): As of 9th June 2020, 36 people were infected by *L. monocytogenes* in enokitake mushroom reported from 17 states. The likely source was identified as the enokitake mushrooms imported from Republic of Korea. Of them, 31 were hospitalised, 4 died from California, Hawaii, and New Jersey, and 6 pregnancy-associated cases with 2 resulting in fetal loss. Epidemiologic, traceback, and laboratory evidence showed that enokitake mushrooms supplied by Green Co. LTD, located in the Republic of Korea, were the likely source of this outbreak. • Australia (2020): 6 cases were reported by whole genome sequencing as being related to the USA outbreak strain. These cases were notified between October 2017 and March 2020. *L. monocytogenes* was detected in enokitake mushrooms imported from South Korea and was recalled on 10 April 2020 by FSANZ. • USA (2017): *L. monocytogenes* in enokitake mushrooms resulted a multi-state outbreak with 5 sickened patients, one of whom died. • USA (2016): a multi-state outbreak caused by *L. monocytogenes* in enoki mushrooms led to 36 illnesses reported, 4 of which were cases of death.
Data on the prevalence of *Listeria monocytogenes* in enoki mushrooms
The US FDA (2023) conducted national testing of *L. monocytogenes* on imported enoki mushrooms from the Republic of Korea, showing 43% of the samples were positive for *L. monocytogenes*, and later added the People's Republic of China (having 15% of enoki mushrooms positive for *L. monocytogenes*) to the list of Import Alert 25-21 based on the samples collected from retail locations in multiple states between October 2020 and January 2023.
A search of the scientific literature from 2000 to 2023 via EBSCO and other publications only identified 4 surveys for *L. monocytogenes* in enoki mushrooms.
These 4 studies from China (3 studies) and Spain indicated a prevalence of *L. monocytogenes* ranging from 0-100% on fresh whole enoki mushrooms, noting the study by Chen et al (2014) was based on a small sample collection post-processing from

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4 different facilities, while the remaining 3 studies were at retailer level. An overall estimation of prevalence at 46.9% (95% Confidence Interval 9.3-88.4%) was determined using a random effect meta-analysis.

Standards or guidelines
Standards 1.6.1 and Schedule 27 provide microbiological limits for *L. monocytogenes* on food. However, this applies to ready-to-eat food, that can or cannot support *L. monocytogenes* growth, being not detected in 25 g products if the growth of *L. monocytogenes* on foods can occur while the requirement is $< 10^2$ CFU/g on foods where no growth can occur. Currently there are no specific requirements on the limit of *L. monocytogenes* on whole plant or fungi products in Australia. Standard 1.2.5 requires food for sale to be appropriately date marked and provides the following definitions: ***best-before date***, for a food for sale, means the date up to which the food for sale will remain fully marketable and will retain any specific qualities for which express or implied claims have been made, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. ***use-by date***, for a food for sale, means the date after which it is estimated that the food for sale should not be consumed because of health or safety reasons, if the food for sale: (a) remains in an intact package during its storage; and (b) is stored in accordance with any storage conditions applicable under Standard 1.2.6. Standard 1.2.6 requires food for sale to be labelled with appropriate storage and use instructions including; if specific storage conditions are required to ensure that the food will keep until the *use-by date or the *best-before date—a statement of those conditions; and if the food must be used or stored in accordance with certain directions for health or safety reasons—those directions. In response to international recalls and alerts in relation to enoki mushrooms, , the Department of Agriculture, Fisheries and Forestry (DAFF) issued an Imported Food Notice (IFN 01-23 - Listeria monocytogenes in enoki mushrooms - DAFF (agriculture.gov.au) in March 2023 to raise awareness of the risk of *L. monocytogenes* contamination in these mushrooms. General guidance for mushroom producers in Australia is available from the Australian Mushroom Growers Association, however, these do not specifically cover enoki mushroom production (AMGA 2020). Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2020). Codex code of hygienic practice for fresh fruit and vegetables *CXC 53-2003* addresses Good Agricultural Practices and Good Hygienic Practices that help control microbial, chemical and physical hazards associated with all stages of the production of fresh fruits and vegetables, from primary production to consumption (Codex 2017). There is industry developed schemes to manage food safety in horticulture. These are audited by a third party against specific requirements. The main schemes used are the Harmonised Australian Retailers Produce Scheme (HARPS, 2022), and schemes that are internationally benchmarked to the Global Food Safety Initiative (GFSI) (FSANZ 2020). Further, Chapter 3 Standards (Food Safety Standards) of the *Australia New Zealand Food Standards Code* applies to food businesses (which includes food importers) that handle or sell horticultural produce. Some requirements in these Standards can apply to activities such as transport and pack house activities (as long as they are not considered to be "primary food production"). Some elements of traceability are also provided through food receipt and recall provisions of Standard 3.2.2, along with labelling requirements under Standard 1.2.2.
Management approaches used by overseas countries
The European Food Safety Authority (EFSA) recommends good hygiene, manufacturing and agricultural practices in food producing countries. The *European Commission Regulation (EC) No 852/2004 – Annex 1 Part A: General hygiene provisions for primary production and associated operations* outlines general provisions for the hygienic production of food, including fresh produce. This includes requirements on water use; health and hygiene of food handlers; cleaning and sanitising of facilities, equipment and vehicles; animal and pest exclusion; storage of waste; and the use of biocides (EU 2004).

Commented [s. 22(1)(a)(i)Any information on NZ?

Commented [s. 22(1)(a)(ii) I have asked and at this point in time MPI is not doing anything specific for enoki. I am not sure how much is being imported but as far as I am aware there have not been any cases reported that have been linked to enoki mushrooms.

Standards or guidelines
Fresh fruit or vegetables imported into Canada must meet Canadian requirements as set out in the *Safe Food for Canadian Regulations* as well as the *Food and Drug Regulations*. Under Section 8 of the *Safe Food for Canadian Regulations* food that is imported, exported or inter-provincially traded must not be contaminated; must be edible; must not consist in whole or in part of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance; and must have been manufactured, prepared, stored, packaged and labelled under sanitary conditions (CFIA 2019b). Additionally, shipments of fresh enoki mushrooms arriving in Canada on or after March 15, 2023 from the Republic of Korea and/or the People's Republic of China must be held and tested (CFIA 2023). In the US, the Produce Safety Rule of the *Food Safety Modernization Act* established science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. This includes requirements for water quality; biological soil amendments; sprouts; domesticated and wild animals; worker training and health and hygiene; and equipment, tools and buildings (FDA 2019b). The USDA has aligned the Harmonized Good Agricultural Practices Audit Program (USDA H-GAP) with the requirements of the FDA Food Safety Modernization Act's Produce Safety Rule. While the requirements of both programs are not identical, the relevant technical components in the FDA Produce Safety Rule are covered in the USDA H-GAP Audit Program. However, the USDA audits are not regarded as a substitute for FDA or state regulatory inspections (FDA 2019a). The FDA has issued an Import Alert (IA) for enoki mushrooms from Republic of South Korea (July 2022) which was extended to China (March 2023) (FDA 2023). The FDA issues these alerts to help prevent potentially violative products from being distributed in the US. After the 2020 outbreak, the FDA implemented an Imported Specialty Mushroom Prevention Strategy, with a focus on enoki mushrooms, to protect public health and prevent future *L. monocytogenes* outbreaks in specialty imported mushrooms. "The FDA's prevention strategies are affirmative, deliberate approaches undertaken by the agency to limit or prevent the recurrence of a root cause that led to an outbreak or adverse incident" (FDA, 2023).

Commented [s. 22(1)(a)(ii)**]** What do these alerts say? Are these products banned from being imported?

Commented [s. 22(1)(a)(ii)**]** No they are not banned. It is only to prevent contaminated product entering the US, and so any suspect product can be detained without inspection. I have expanded this by including a quote from the Import Alert.

This draft risk statement was compiled in: June 2023

References

ABS (2014) Australian health survey: Nutrition first results - Foods and nutrients, 2011-12. Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.007main+features12011-12. Accessed January 2023.

AMGA (2020) Enoki Mushrooms - Australian Mushroom Growers Accessed 18th April 2023.

CFIA (2019a) Overview - Importing fresh fruit or vegetables. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/importing-food/food-specific-requirements/fresh-fruit-or-vegetables/eng/1541613882667/1541613882890 . Accessed 21 June 2019.

CFIA (2019b) Regulatory requirement: Trade: Safe Food for Canadians Regulations, Part 2. Canadian Food Inspection Agency, Ottawa. http://inspection.gc.ca/food/requirements-and-guidance/food-licensing/trade/eng/1539883860127/1539883860720 . Accessed 21 June 2019.

CFIA (2023) Notice to industry: new licence requirements for enoki mushrooms. . Canadian Food Inspection Agency, Ottawa. Notice to industry: new licence requirements for enoki mushrooms - Canadian Food Inspection Agency (canada.ca) . Accessed 26 April 2023.

Chen M, Cheng J, Wu Q, Zhang J, Chen Y, Zeng H, Ye Q, Wu S, Cai S, Wang J and Ding Y (2018) Prevalence, potential virulence, and genetic diversity of *Listeria monocytogenes* isolates from edible mushrooms in Chinese markets. Front. Microbiol. 9:1711.

Chen M, Wu Q, Zhang J, Guo W, Wu S, Yang X. (2014) Prevalence and contamination patterns of *Listeria monocytogenes* in *Flammulina velutipes* plants. Foodborne Pathog. Dis. 11(8):620-7.

Chung SY, Cho TJ, Yu H, Park SG, Kim, Kim S-R, Kim SA, Rhee MS. (2023) Efficacy of combined caprylic acid and thymol treatments for inactivation of *Listeria monocytogenes* on enoki mushrooms in household and food-service establishments. Food Res. Int. 166:112601

Codex (2017) Code of hygienic practice for fresh fruits and vegetables (CXC 53-2003). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-

proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B53-2003%252FCXC_053e.pdf . Accessed April 2023.

Codex (2020) General principles of food hygiene (CXC 1-1969). Codex Alimentarius Commission, Rome. http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf . Accessed April 2023

Dowom SA, Rezaeian S, Pourianfar HR. (2019) Agronomic and environmental factors affecting cultivation of the winter mushroom or enokitake: achievements and prospects. Appl. Micro. Biotech. 103:2469-2481.

EU (2004) Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32004R0852 . Accessed 21 June 2019

Farber JM, Coates F, Daley E (1992) Minimum water activity requirements for the growth of *Listeria monocytogenes*. Lett. Appl. Micro. 15:103–105.

Fay ML, Salazar JK, George J, Chavda NJ, Lingareddygari P, Patil GR, Juneja VK, Ingram DT. (2023) Modelling the fate of *Listeria monocytogenes* and *Salmonella enterica* on fresh whole and chopped wood ear and enoki mushrooms. J. Food Protect. 86:100075

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition. Accessed 23 May 2019

FDA (2019a) Frequently asked questions on FSMA . US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma. Accessed 29 August 2019

FDA (2019b) FSMA final rule on produce safety. US Food and Drug Administration, Silver Spring. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-final-rule-produce-safety. Accessed 24 June 2019

FDA (2023) FDA expands Country-wide import alert for enoki mushrooms to China https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

FSANZ (2013) Agents of foodborne illness. http://www.foodstandards.gov.au/publications/Documents/Listeria%20monocytogenes.pdf. Accessed April 2023

FSANZ (2020) Proposal P1052 - PPP requirements for horticulture (berries, leafy vegetables and melons): First call for submission - Supporting document 2: Food safety measures for horticultural produce. Food Standards Australia New Zealand, Canberra. https://www.foodstandards.gov.au/code/proposals/Pages/P1052.aspx. Accessed 5 March 2023

FSANZ (unpublished) FSANZ internal preliminary risk assessment for *Listeria monocytogenes* and fresh enoki mushrooms. Internal FSANZ document Version 2. Accessed April 2023.

HARPS (2022) HARPS standard Version 2.0. Harmonised Australian Retailer Produce Scheme - Harps Online Accessed on 13 February 2023

Kim SR, Kim WI, Yoon JH, Jeong D, Choi SY, Hwang I, Rajalingam N. (2020) Growth survival of *Listeria monocytogenes* in enoki mushroom (*Flammulina velutipes*) at different temperatures and anti-listerial effect of organic acids. J. Food Hyg. Safety 35 (6): 630-636.

Kirk M, Glass K, Ford L, Brown, K., Hall, G. (2014) Foodborne illness in Australia: Annual incidence circa 2010. Department of Health, Canberra. https://www1.health.gov.au/internet/main/publishing.nsf/Content/E829FA59A59677C0CA257D6A007D2C97/$File/Foodborne-Illness-Australia-circa-2010.pdf. Accessed 14 July 2020

Lado B, Yousef AE (2007) Characteristics of *Listeria monocytogenes* important to food processors. In: Ryser E, Marth E (eds) Listeria, listeriosis and food safety, 3rd. CRC Press Taylor & Francis Group, Boca Raton, pp 157–213

Ryser ET, Buchanan RL (2013) *Listeria monocytogenes*. In: Doyle MP, Buchanan RL (eds) Food microbiology: Fundamentals and frontiers, 4th edn., Ch 20. ASM Press, Washington DC, pp 503–545

Sutherland PS, Miles DW, Laboyrie DA (2003) *Listeria monocytogenes*. In: Hocking A (ed) Foodborne microorganisms of public health significance, 6th. Australian Institute of Food Science and Technology (NSW Branch), Sydney, pp 381–443

US CDC (2020) Outbreak of *Listeria* infections linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-mushrooms-03-20/index.html. Accessed 12 December 2022.

US CDC (2022) *Listeria* outbreak linked to enoki mushrooms. https://www.cdc.gov/listeria/outbreaks/enoki-11-22/index.html . Accessed 12 December 2022

US FDA (2023) Import Alert 25-21 Detention Without Physical Examination of Enoki Mushrooms from the Republic of Korea and China due to *Listeria monocytogenes*. https://www.accessdata.fda.gov/cms_ia/importalert_1177.html. Accessed 29th March 2023.

US Mushroom Council (2021) Versatility in Varieties. https://www.mushroomcouncil.org/wp-content/uploads/2021/04/All-About-Mushrooms-Kit.pdf . Accessed April 2023

Venturini M.E., Reyes J.E., Rivera C.S., Oria R., Blanco, D. (2011) Microbiological quality and safety of fresh cultivated and wild mushrooms commercialized in Spain. *Food Micro.*, 28(8): 1492-1498.

Wu S, Wu Q, Zhang J, Chen M, Yan Z, Hu H (2015) *Listeria monocytogenes* prevalence and characteristics in retail raw foods in China. *PLoS ONE* 10(8): e0136682.

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 16 March 2023 4:49 PM
To: s. 22(1)(a)(ii)
Subject: RE: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

I have added my comments 😊

s. 22(1)(a)(

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Tuesday, 14 March 2023 5:11 PM
To: Imported Food Program <QEO-FoodSafetyUnit@agriculture.gov.au>
Subject: FW: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

Good evening team

FSANZ has provided a preliminary risk assessment for enoki mushrooms and *L. monocytogenes*.
Please find it here for your review/ comments.

If we can get your feedback by COB Monday (20 March 2023) that would be great.

Kind regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 8 March 2023 5:15 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

OFFICIAL: Sensitive

Hi s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

FSANZ has now completed our preliminary risk assessment for *Listeria monocytogenes* and enoki mushrooms.

Cheers,

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: +s. 47F(1)
m: s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Friday, 17 March 2023 10:41 AM
To: s. 22(1)(a)(ii)
Subject: RE: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

Hi s. 22(1)(a)(ii)

Thank you for providing the risk assessment for review.
It certainly is a technically complex and detailed assessment.
My only comment is regarding the acceptance of food product labelling and the effectiveness of any control (kill step) if we allow vague labelling statements about cooking instructions, and therefore do not test the product for *L. mono*.

Kind regards
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Tuesday, 14 March 2023 5:11 PM
To: Imported Food Program <QEO-FoodSafetyUnit@agriculture.gov.au>
Subject: FW: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

Good evening team

FSANZ has provided a preliminary risk assessment for enoki mushrooms and *L. monocytogenes*.
Please find it here for your review/ comments.

If we can get your feedback by COB Monday (20 March 2023) that would be great.

Kind regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 8 March 2023 5:15 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

OFFICIAL: Sensitive

Hi s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

FSANZ has now completed our preliminary risk assessment for *Listeria monocytogenes* and enoki mushrooms.

Cheers,

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: s. 47F(1)
m: s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Tuesday, 2 May 2023 2:10 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: Request for import data for enoki mushrooms (2010 - 2022) [SEC=OFFICIAL]

HI s. 22(1)(a)(ii)

The below table shows import volume of fresh enoki mushrooms from 2010 – 2022.

Year	Quantity (kg)
2010	169,900.00
2011	192,242.00
2012	268,588.00
2013	298,289.15
2014	344,871.80
2015	446,321.10
2016	487,008.00
2017	657,982.00
2018	802,241.30
2019	1,437,640.66
2020	2,017,866.00
2021	2,047,910.87
2022	2,226,682.90
Grand Total	**11,397,543.78**

The data can be viewed here if you're interested.

Cheers,
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 1 May 2023 11:59 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: Request for import data for enoki mushrooms (2010 - 2022) [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii) and s. 22(1)(a)(i

FSANZ has requested import data for enoki mushrooms – 2010 – 2022.
They want to correlate import volumes over a period of time to the increasing consumption of enoki mushrooms.

Thank you so much.
Kind regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 27 April 2023 10:05 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii)

s. 22(1)(a)(ii)@aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: Draft risk statement for Enoki Mushrooms and Listeria monocytogenes attached [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached a draft risk statement for *Listeria monocytogenes* and enoki mushrooms for your consideration. I draw your attention to two comments in the document that I would appreciate comment on.

1. The scope of the statement was not agreed through the usual channels, so I have put something together in line with other statements. If you could check that the wording is appropriate for DAFF.
2. There is a lack of consumption data specifically for enoki mushrooms as opposed to general mushroom consumption which would be mainly button and portobello mushrooms and so I was wondering if it might be useful to consider import levels as a reflection of increasing use of enoki mushrooms. Would you be able to supply import data from 2010 to 2022?

I look forward to your comments in due course.

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Tuesday, 21 March 2023 1:34 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

Hi s. 22(1)(a)(ii)

I did have a look at it and had no comments to add other than it was interesting to read the report of the risk assessment. It was the first time I had seen one. Far more detailed that the risk statement prepared for the department.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Project Manager | Imported Food
Phone +s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @aff.gov.au

Department of Agriculture, Fisheries and Forestry
Residues and Food Branch
Agriculture House, 70 Northbourne Ave, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Tuesday, 21 March 2023 1:16 PM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii)
s. 22(1)(a)(ii) @aff.gov.au>
Subject: FW: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

Good afternoon s. 22(1)(a)(ii)

FSANZ is requesting a meeting regarding enoki mushrooms. I was wanting to know if you have had a chance to look at the preliminary advice that was sent to us by FSANZ?
We can discuss these at the meeting.

Nicky is it possible for you to provide some feedback too.

Thank you for looking at it. I understand you both have extremely hectic schedules.

Kind regards
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Tuesday, 14 March 2023 5:11 PM
To: Imported Food Program <QEO-FoodSafetyUnit@agriculture.gov.au>
Subject: FW: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

Good evening team

FSANZ has provided a preliminary risk assessment for enoki mushrooms and *L. monocytogenes*.
Please find it here for your review/ comments.

If we can get your feedback by COB Monday (20 March 2023) that would be great.

Kind regards
Sheba

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 8 March 2023 5:15 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

OFFICIAL: Sensitive

Hi s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

FSANZ has now completed our preliminary risk assessment for *Listeria monocytogenes* and enoki mushrooms.

Cheers,

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: +s. 47F(1)
m: s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 30 March 2023 9:22 AM
To: s. 22(1)(a)(ii)
Cc: s. 47F(1)
Subject: Enoki Mushrooms and Listeria risk statement [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii) s. 22(1)(a)(ii)

This email is to confirm that I will be preparing a draft risk statement for Enoki mushrooms and Listeria following discussions you had with s. 47F(1) last week. As most of the information is to hand with the completion of the risk advice tha[s. 47F(1)] prepared, I think that the draft document can be completed relatively quickly.

Just as an FYI for enoki - I note that Canada has a "test and hold" requirement now in place for enoki mushrooms. https://inspection.canada.ca/importing-food-plants-or-animals/food-imports/food-import-notices-for-industry/2023-02-27/eng/1677785158318/1677785158990 . We are seeking further clarification on what this entails from CFIA. Similarly, FDA has extended their Import Alert to now include enoki mushrooms from China as well as Korea, following significant detections in shipments sampled and the multi-state outbreak linked to enoki mushrooms from China. https://www.fda.gov/food/cfsan-constituent-updates/fda-expands-country-wide-import-alert-enoki-mushrooms-china

I also wanted to apologise for the delay in sending you the two draft risk statements for Dates and HepA and Dates and Salmonella. I was unexpectedly called away on urgent family business, but I am now back in office and will focus on completion of these drafts asap.

If you have any questions, please let me know

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

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s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Monday, 12 December 2022 11:12 AM
To: s. 22(1)(a)(ii) Helen Withers
Cc: s. 22(1)(a)(ii)
Subject: RE: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

OFFICIAL

Thanks s. 22(1)(a)(ii)

An annual amount in tonnes/kg of fresh enoki imports would be very helpful for the preliminary advice which I hope to have cleared on Wednesday.

Cheers

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

s. 47F(1)
s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 12 December 2022 9:29 AM
To: s. 47F(1) @foodstandards.govt.nz>
Cc: s. 47F(1) @foodstandards.gov.au>s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hello s. 47F(1)

Thank you for your email.

Please send the final draft to me once finalised so that I can get a final clearance from my director.

I will get back to you on the Enoki data.

Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Friday, 9 December 2022 12:37 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @awe.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>
Subject: Following up items discussed at the interagency meeting yesterday [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

I am just following up on a couple of items from the FSANZ-DAFF meeting yesterday.

The first was to confirm that we are in the final stages of revising the draft melon risk statements. We have made edits in response to the comments from s. 22(1)(a)(ii) and s. 22(1)(a)(ii) The main change that we have made has been to add some more Australian consumption data, expanding that section of the documents to include data for honeydew, rockmelon and watermelon both as single foods but also consumed as mixed foods (eg fruit salads).

I just wanted to confirm if you would like to see the revised documents again once we have completed revision before we finalise them for clearance and publishing? I am happy to send them through once s. 47F(1) has completed her clearance review. If not, then we will send them on to the General Manager for clearance.

The microbiology team are putting together information on enoki mushrooms due to the identified risk of *Listeria monocytogenes* which s. 47F(1) presented at the meeting yesterday. Is it possible for you to tell us the yearly amount of enoki mushrooms that are imported into Australia?

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 9 March 2023 8:55 AM
To: s. 22(1)(a)(ii)
Subject: FW: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]
Attachments: FSANZ Listeria and enoki RA 2023.docx

See attached advise received.

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 8 March 2023 5:15 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: FSANZ Preliminary Risk Assessment for Listeria monocytogenes and Enoki Mushrooms [SEC=OFFICIAL:Sensitive]

OFFICIAL: Sensitive

Hi s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

FSANZ has now completed our preliminary risk assessment for *Listeria monocytogenes* and enoki mushrooms.

Cheers,

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

s. 47F(1)

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Wednesday, 11 January 2023 4:39 PM
To: s. 22(1)(a)(ii)
Subject: FW: FOR ACTION: Risk advise - Enoki mushroom [SEC=OFFICIAL]
Attachments: 2023 01 04 - enoki mushroom - Leemhuis to Fischer.docx; Receipt of letter - Enoki mushroom - Fischer to Leemhuis.docx

fyi

From: s. 22(1)(a)(ii)
Sent: Wednesday, 11 January 2023 4:38 PM
To: Fischer, Vikki <Vikki.Fischer@aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: FOR ACTION: Risk advise - Enoki mushroom [SEC=OFFICIAL]

Hello Vikki

Please find attached a letter from Christel Leemhuis in reply to the letter we send on 22 December 2022 requesting risk advice for imported enoki mushrooms. Also attached is a draft letter for your consideration in response to FSANZ request to capture imported enoki mushrooms for border surveillance testing for *Listeria monocytogenes.*

While we do have powers under the Imported Food Control Regulations to implement a surveillance program, we currently do not have a framework in place to manage this process. Actioning the request from FSANZ means using powers under the IFC legislation that we have not previously used, and we need to consider carefully before implementing.

In addition, before we can sample goods at the border using these powers we must seek importer permission and the department would be responsible for covering the cost of the testing and analysis. We also need to consider how to manage this within our systems, as it would be a change to the usual 5% referral of surveillance food. The enoki mushrooms would be referred to us at 100% and would need to be easily identifiable as subject to this surveillance testing, as opposed to the usual testing under the IFIS.

Happy to have a discussion about this if needed.

Kind Regards

s. 22(1)(a)(ii)
Assistant Director | Risk Management and International Engagement| Imported Food Section |s. 22(1)(a)(ii) |s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Travellers, Mail and Imported Food Branch | Biosecurity Operations Division
CQ2, 70 Northbourne Avenue, Canberra City ACT 2601 Australia
GPO Box 858 Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 22(1)(a)(ii)
Sent: Thursday, 22 December 2022 10:28 AM
To: Fischer, Vikki <Vikki.Fischer@aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: Risk advise request - Enoki mushrooms FINAL.docx [SEC=OFFICIAL]

Vikki - Well noted.

Regards,
s. 22(1)(a)(ii)

From: Fischer, Vikki <Vikki.Fischer@aff.gov.au>
Sent: Thursday, 22 December 2022 10:08 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: Risk advise request - Enoki mushrooms FINAL.docx [SEC=OFFICIAL]

Thanks s. 22(1)(a)(ii)

Please find attached the letter, unchanged except for date and signature

Could you please progress this on my behalf, with our best wishes for the festive season?

Thanks again and kind regards

Vikki Fischer

Assistant Secretary
Travellers, Mail & Imported Food
Biosecurity Operations Division
Dept of Agriculture, Fisheries & Forestry

6272 3686
s. 47F(1)
Vikki.fischer@awe.gov.au

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 1 June 2023 3:04 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: Enoki seasonality and frequency data for FSANZ risk advice [SEC=OFFICIAL]

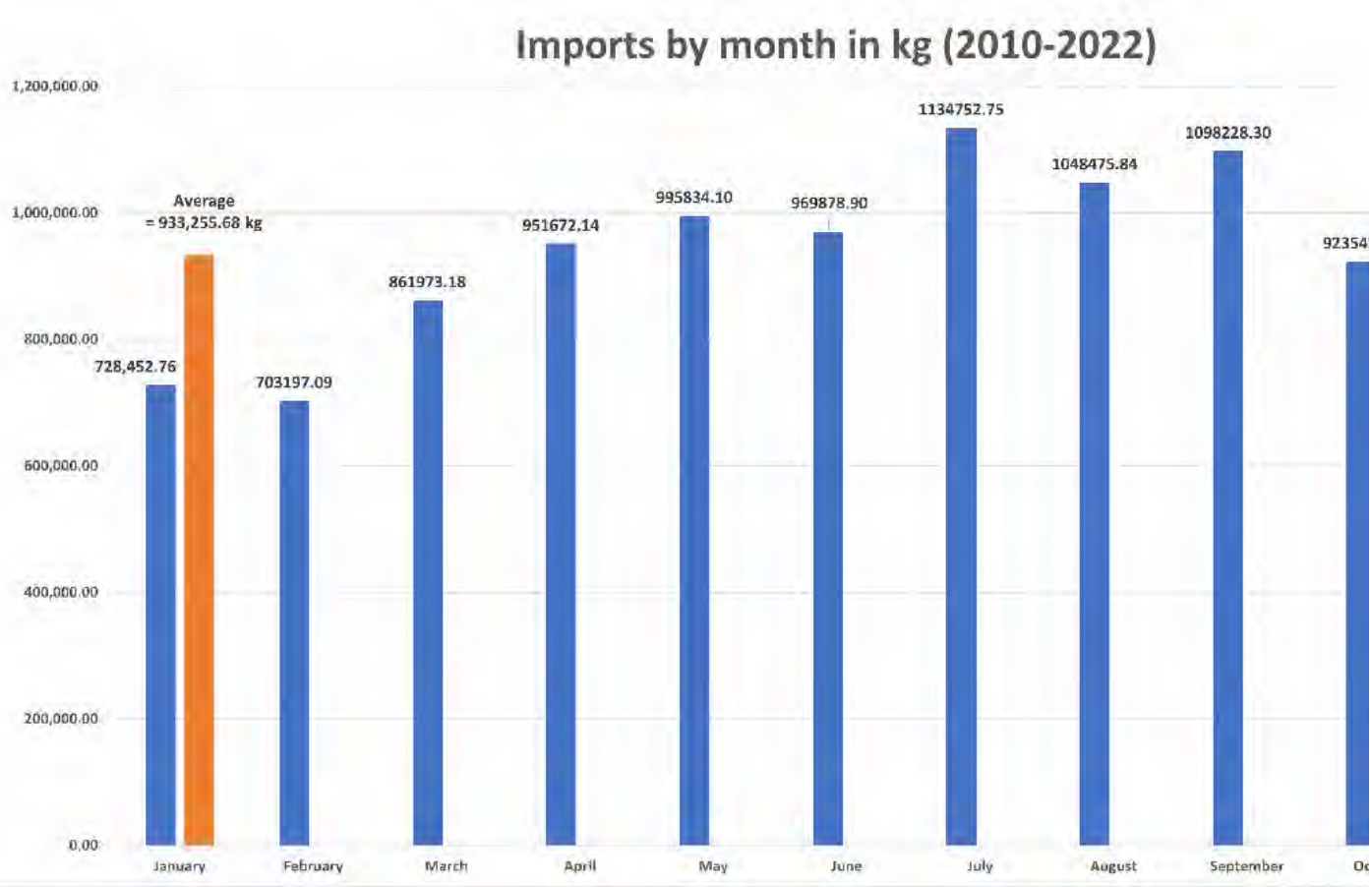
Dear s. 22(1)(a)(ii)

Please find the updated data below.
Unsure why it gave me such high numbers last time, but the method I used today seemed to much more accurately represent reality.

Seasonality:

Using entries from 01 Jan 2010 – 31 Dec 2022 (not including 2023 data in graph as it will skew data for Jan thru May), I sorted by month then summed the total monthly values, and plotted this monthly sum against each month. (January data contains total import volumes from Jan 2010, 2011, 2012, 2013, …, 2022, etc, and so on for February - December as well)

I can explain what I mean if you are still confused.



Frequency:

Many of the importers (~20) either only imported enoki once, or only the odd few times.

The data show only 14 importers that import enoki mushrooms more than once a month (usually importing large volumes just about every time), the remainder import less frequently (once every month or so) with usually lesser volumes than the big importers.

Please let me know if you have any questions.

Kind Regards,

s. 22(1)(a)(ii)
Technical Officer
Imported Food| Residues and Food Branch | Exports and Veterinary Services Division
Australian Government Department of Agriculture, Fisheries and Forestry
CQ2, 70 Northbourne Avenue, Canberra 2601, Australia | GPO Box 858, Canberra ACT 2601, Australia
T: +s. 22(1)(a)(ii) | M: +s. 22(1)(a)(ii) | **E:** s. 22(1)(a)(ii)@aff.gov.au

---

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Wednesday, May 31, 2023 12:32 PM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: Enoki seasonality and frequency data for FSANZ risk advice [SEC=OFFICIAL]

Hi s. 22(1)(a)(i
Just following this enoki data – is it good to go?
Cheers
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, May 22, 2023 5:21 PM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: Enoki seasonality and frequency data for FSANZ risk advice [SEC=OFFICIAL]

Dear s. 22(1)(a)(ii)

Hold off on sending this one through to FSANZ.
I think I may have included duplicates in my data and will double check them tomorrow/get back to you.

Kind Regards,

s. 22(1)(a)(ii)
Technical Officer
Imported Food| Residues and Food Branch | Exports and Veterinary Services Division
Australian Government Department of Agriculture, Fisheries and Forestry
CQ2, 70 Northbourne Avenue, Canberra 2601, Australia | GPO Box 858, Canberra ACT 2601, Australia
T: +s. 22(1)(a)(ii) | M: +s. 22(1)(a)(ii) | **E:** s. 22(1)(a)(ii)@aff.gov.au

---

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 22 May 2023 4:05 PM
To: s. 22(1)(a)(ii) @aff.gov.au>

Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: Enoki seasonality and frequency data for FSANZ risk advice [SEC=OFFICIAL]

Dear s. 22(1)(a)(ii)

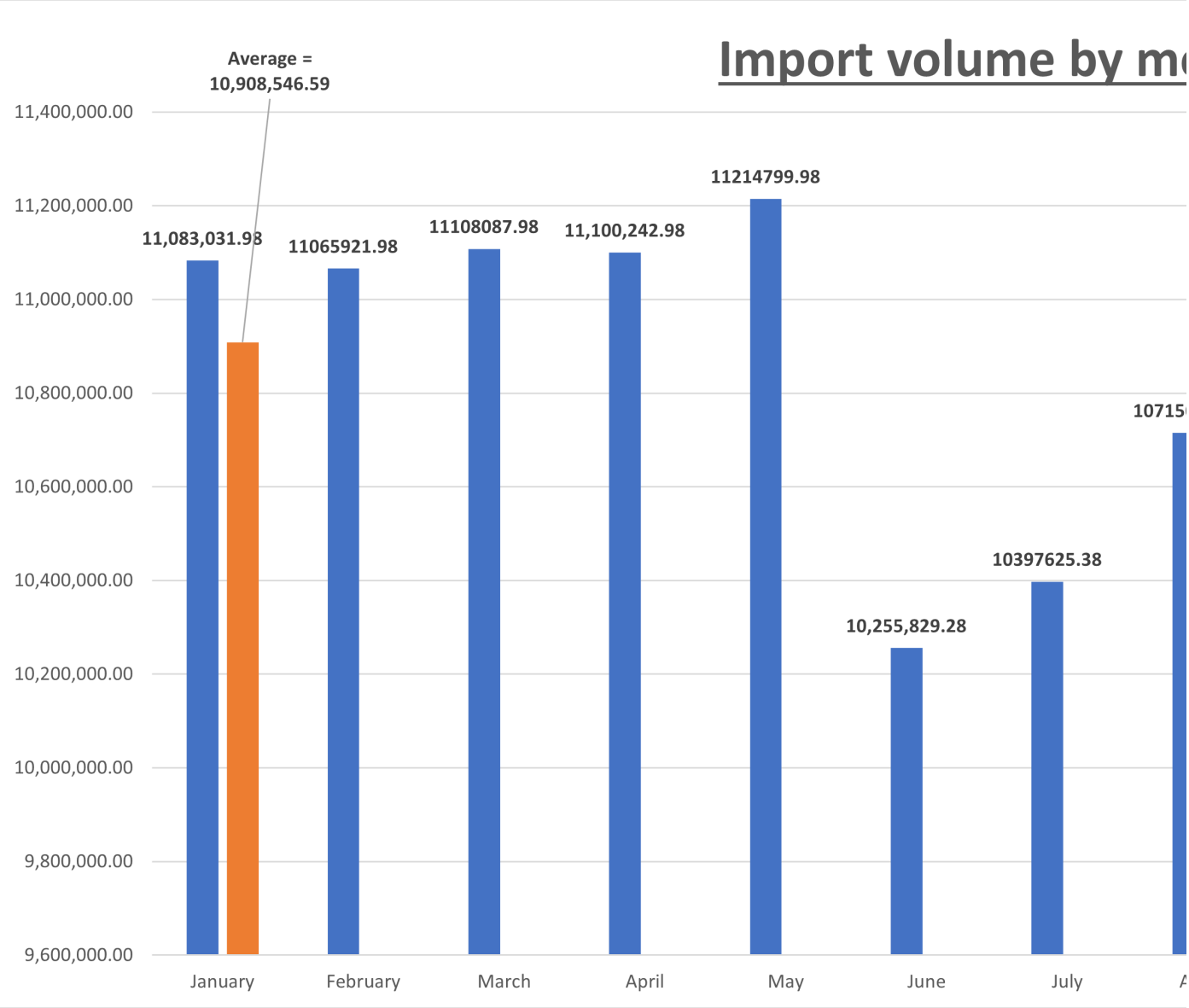
Please find the a graph regarding the overall import seasonality and import frequency information below.

Seasonality:

Using entries from 01 Jan 2010 – 31 Dec 2022 (not including 2023 data in graph as it will skew data for Jan thru May), I sorted by month then summed the total monthly values, and plotted this monthly sum against each month. (January data contains total import volumes from Jan 2010, 2011, 2012, 2013, …, 2022, etc, and so on for February - December as well)

I can explain what I mean if you are still confused.

From this data a clear a clear seasonality of imports of enoki is seen.



Frequency:

Many of the importers (~20) either only imported enoki once, or only the odd few times.

The data show only 14 importers that import enoki mushrooms more than once a month (usually importing large volumes just about every time), the remainder import less frequently (once every month or so) with usually lesser volumes than the big importers.

Please let me know if you have any questions.

Kind Regards,

s. 22(1)(a)(ii)
Technical Officer
Imported Food| Residues and Food Branch | Exports and Veterinary Services Division
Australian Government Department of Agriculture, Fisheries and Forestry
CQ2, 70 Northbourne Avenue, Canberra 2601, Australia | GPO Box 858, Canberra ACT 2601, Australia
T: +s. 22(1)(a)(ii) | M: +s. 22(1)(a)(ii) | **E:** s. 22(1)(a)(ii)@aff.gov.au

s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) <s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 2 February 2023 4:19 PM
To: s. 47F(1) s. 22(1)(a)(ii)
Cc: s. 47F(1)
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Hello s. 47F(1)

Please see below import data on enoki mushrooms

- The total quantity of fresh or frozen enoki mushrooms between 2019 and 2022 was 7,634,531.8 kg.
- Import quantities have been increasing year by year between 2019 and 2022 – a 38% increase in total quantity imported in 2020 compared to 2019, a 3.4% increase in total quantity imported in 2021 compared to 2020, and a 7.4% increase in total quantity imported in 2022 compared to 2021.
- In terms of quantity, 86.5% of enoki mushrooms are imported from Sth Korea. All fresh and frozen product is imported from China and Sth Korea.
- In 2022, 7 importers brought in product from 11 producers in China; 13 importers brought in product from 21 producers in Sth Korea.

Row Labels	**Sum of Quantity**	**% growth to previous year**
2019	1429568.7	
2020	1973306.0	38.0%
2021	2040566.3	3.4%
2022	2191090.9	7.4%
Grand Total	**7634531.8**	

Row Labels	**Sum of Quantity**	% of import amounts by country
CHINA	1029339.95	13.5%
REPUBLIC OF KOREA	6605191.88	86.5%
Grand Total	**7634531.83**	

Creation date (Year)	**Country**	**Sum of Quantity**
2019	CHINA	135178.1
	REPUBLIC OF KOREA	1294390.6
2020	CHINA	296817.5
	REPUBLIC OF KOREA	1676488.5
2021	CHINA	293325.8
	REPUBLIC OF KOREA	1747240.5
2022	CHINA	304018.6
	REPUBLIC OF KOREA	1887072.3
Grand Total		**7634531.8**

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Wednesday, 1 February 2023 8:37 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @awe.gov.au>; Ts. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Following on from the meeting we had in January, I have a couple of follow on questions regarding the amount of enoki mushrooms to help inform the risk assessment.

- I just wanted to confirm that there have been 7,395,998 kg enoki mushrooms imported from Republic of Korea and China since 2019?
- Is the same amount imported each year over that period (ie can we divide by 4 to get a yearly import volume) or has there been a significant increase over time?
- I recall that we import more from one of the two countries mentioned. Can you confirm which country that is?

Thanks

s. 47F(1)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 18 January 2023 1:20 pm
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.govt.nz>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

Hi all

Thanks for the meeting – good to have that discussion. Just quickly capturing the action items:

1. DAFF to confirm if a survey is possible (ie purchase post-border/retail imported enoki and test)
    a. If yes, FSANZ to advise number of samples and if all producers from China & South Korea
2. DAFF to consider if advice can be sent to importers or via IFCC
    a. FSANZ to provide key points to be included about potential food safety risk
3. DAFF to review if any producers subject to the recalls in US & Canada are exporting to Australia
4. FSANZ to follow up via SEAWG and whether jurisdictions can test retail product (both domestic and imported)
    a. FSANZ to consider advice on sampling etc
5. FSANZ to continue with risk assessment

Regards
s. 47F(1)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 16 January 2023 3:34 PM
To: s. 47F(1) @foodstandards.govt.nz>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) t@foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]
Importance: High

Hello s. 47F(1)

I forwarded the attached letter from Christel to Vikki. We discussed the letter and Vikki suggested we have a meeting with you and Nora.

What is your availability Wednesday and Thursday this week? Apologies for the short notice.

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 5 January 2023 8:35 AM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @awe.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached a letter from Christel Leemhuis in reply to Ms Fischer's letter dated 22 December 2022 requesting risk advice for imported enoki mushrooms.

As noted in the response we will start preparing the requested risk advice as soon as possible.

If you have any questions or concerns about this work, please do not hesitate to get in touch and we can arrange a suitable meeting time to discuss.

Best Regards

s. 47F(1)

---

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 22 December 2022 2:42 pm
To: s. 47F(1) @foodstandards.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hello s. 47F(1)

Please find attached a letter from Vikki Fischer to Christel Leemhuis requesting formal risk advice for enoki mushrooms.

s. 22(1)(a)(ii) requested not for anything to be published until we had a look at the draft risk advise for enoki mushrooms.

Vikki asked that I pass on her best wishes for the festive season.

Kind Regards

s. 22(1)(a)(ii)
Assistant Director | Risk Management and International Engagement| Imported Food Section |s. 22(1)(a)(ii) |s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Travellers, Mail and Imported Food Branch | Biosecurity Operations Division
CQ2, 72 Northbourne Avenue, Canberra City ACT 2601 Australia
GPO Box 858 Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 47F(1) @foodstandards.gov.au>
Sent: Thursday, 15 December 2022 8:47 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

Thanks s. 22(1)(a)(ii)

I have completed a preliminary risk assessment that is currently with Christel for clearance but the letter will be very helpful so please do send it through.

Are we able to provide you with the preliminary risk assessment before the end of the year in the first instance to help justify/guide the surveillance if it is for something that might pose a risk to public health and safety? Do we need to publish this online in the first instance or can it just be provided to you to help decision making re surveillance? We can then also do up formal risk advice in the standard template for publication on the website in the new year?

s. 47F(1) is across this work and will be able to handle any questions and progress this for you in my absence.

And thank you for the data, that was extremely useful for the RA.

Happy holidays!

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology
s. 47F(1)

e: s. 47F(1) @foodstandards.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 15 December 2022 8:33 AM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

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Hi s. 47F(1)

Thank you for the information.

I am in the process drafting a letter to request formal risk advise for enoki mushrooms.

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 14 December 2022 4:54 PM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

FYI just came across this while finishing off advice. FDA recall enoki

https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts/utopia-foods-recalls-enoki-mushrooms-because-possible-health-risk#:~:text=Utopia%20Foods%20Inc%20of%20Glendale,in%20young%20children%2C%20frail%20or

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology
s. 47F(1)

e: s. 47F(1) @foodstandards.gov.au

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s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 5 January 2023 8:35 AM
To: s. 22(1)(a)(ii)
Cc: s. 47F(1)
Subject: RE: FDA recall enoki [SEC=OFFICIAL]
Attachments: 2023 01 04 - enoki mushroom - Leemhuis to Fischer.docx

OFFICIAL

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Please find attached a letter from Christel Leemhuis in reply to Ms Fischer's letter dated 22 December 2022 requesting risk advice for imported enoki mushrooms.

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If you have any questions or concerns about this work, please do not hesitate to get in touch and we can arrange a suitable meeting time to discuss.

Best Regards

s. 47F(1)

---

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

s. 47F(1)
e: s. 47F(1) @foodstandards.govt.nz

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From: s. 22(1)(a)(ii) @aff.gov.au>
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To: s. 47F(1) @foodstandards.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

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Assistant Director | Risk Management and International Engagement| Imported Food Section |s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
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agriculture.gov.au

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Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

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s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

t: s. 47F(1)

m: s. 47F(1)
e: s. 47F(1) @foodstandards.gov.au

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From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 15 December 2022 8:33 AM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

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Hi s. 47F(1)

Thank you for the information.

I am in the process drafting a letter to request formal risk advise for enoki mushrooms.

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 14 December 2022 4:54 PM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

FYI just came across this while finishing off advice. FDA recall enoki

https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts/utopia-foods-recalls-enoki-mushrooms-because-possible-health-risk#:~:text=Utopia%20Foods%20Inc%20of%20Glendale,in%20young%20children%2C%20frail%20or

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

s. 47F(1)

s. 47F(1) @foodstandards.gov.au

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Monday, 9 January 2023 12:46 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: FDA recall enoki [SEC=OFFICIAL]
Attachments: 2023 01 04 - enoki mushroom - Leemhuis to Fischer.pdf

s. 22(1)(a)(ii) thank you for the information.

s. 22(1)(a)(ii) as per my email on 23 December 2022, FSANZ request us to consider capturing imported enoki mushrooms for border surveillance testing for L. *monocytogenes* while they complete the risk advice. We have not forwarded the attached letter to Vikki (Sheba, correct me if I am wrong). I take it we will need to provide Vikki with an action plan with the attached letter?

Can you please advise what the next steps are or do you prefer I schedule a meeting between us to discuss?

Regards
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 5 January 2023 7:03 PM
To: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii) and s. 22(1)(a)(ii)

The 'new' power in the legislation to enable active monitoring where an emerging risk to human health is identified in a surveillance food (legislation was amended in 2018 following the hep A outbreak in frozen berries) is here:

In the IF Regulations - section 15:

Surveillance food where emerging risk to human health

(2) For the purposes of paragraph 16(2)(ab) of the Act, the Secretary may make an order that, in respect of surveillance food of a specified kind, 100% of consignments of food of that kind must be referred by an officer of Customs for inspection, or inspection and analysis, under the Scheme.

Note 1: See section 35B of the Act for how an order may refer to a kind of food.

Note 2: The Secretary may, in the order, also specify rates of inspection, or inspection and analysis, and rates of sampling that are to apply to the food referred by an officer of Customs: see subsection 21(2) of this instrument.

(3) The Secretary may make an order under subsection (2) only if the Secretary is satisfied in relation to food of that kind:

(a) that there may be an emerging risk to human health; and

(b) that the best available scientific evidence to the Secretary is insufficient to enable the conduct of an accurate assessment of the risk; and

(c) that the risk needs to be further investigated.

(4) An order under subsection (2) must specify the period during which the order is in force, which must not be more than 6 months after the day on which the order is made.

(5) An order under subsection (2) ends at the earlier of the following times:

(a) at the end of the period specified in the order;

(b) the time when the order is revoked.

(6) Before an order ends under paragraph (5)(a), the Secretary must review the appropriateness of the order.

IFC Act Section 16 (1) and (2)(ab) state:

(1) The regulations may set out particulars of a food inspection scheme (***Scheme***) applicable to all food to which this Act applies.
(2) Without limiting subsection (1), the regulations setting out particulars of the Scheme may:

(ab) empower the Secretary to make an order, in respect of food that is classified into a particular category and is of a particular kind, specifying the percentage of food of that kind that must be referred by an officer of Customs for inspection, or inspection and analysis, under the Scheme;

If FSANZ request for samples to be taken from imported enoki mushrooms in order to assess an emerging risk, I believe we could use this power to refer enoki mushrooms for inspection and sampling at a higher rate, for the purposes stated above in s15(3) of the Regs?

Happy to discuss over the next few weeks and when s. 22(1)(a)(ii) returns.

s. 22(1)(a)(ii)

s. 22(1)(a)(ii)

Project Manager | Imported Food
Phone +s. 22(1)(a)(ii) | Email s. 22(1)(a)(ii) @aff.gov.au

Department of Agriculture, Fisheries and Forestry
Biosecurity Operations Divison
CQ2, 70 Northbourne Ave, Canberra City ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Friday, 23 December 2022 12:15 PM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>
Subject: FW: FDA recall enoki [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

Following the request for risk advice I send to FSANZ, we met with s. 22(1)(a)(ii) this morning.

FSANZ would like us to undertake sampling for Listeria in enoki mushrooms. I understand that you mention engaging with an external company to conduct surveillance on domestic product, but FSANZ is after both domestic and import sampling data as they have concerns with enoki mushrooms and the high levels of Listeria reported overseas.

I asked them to send me an email requesting this information so this is just a heads-up email.

Kind Regards
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Thursday, 22 December 2022 12:42 PM
To: s. 47F(1) @foodstandards.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Hello s. 47F(1)

Please find attached a letter from Vikki Fischer to Christel Leemhuis requesting formal risk advice for enoki mushrooms.

s. 22(1)(a)(ii) requested not for anything to be published until we had a look at the draft risk advise for enoki mushrooms.

Vikki asked that I pass on her best wishes for the festive season.

Kind Regards

s. 22(1)(a)(ii)
Assistant Director | Risk Management and International Engagement| Imported Food Section |s. 22(1)(a)(ii) |s. 22(1)(a)(ii)

Department of Agriculture, Fisheries and Forestry
Travellers, Mail and Imported Food Branch | Biosecurity Operations Division
CQ2, 72 Northbourne Avenue, Canberra City ACT 2601 Australia
GPO Box 858 Canberra ACT 2601 Australia

agriculture.gov.au

From: s. 47F(1) @foodstandards.gov.au>
Sent: Thursday, 15 December 2022 8:47 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

Thanks s. 22(1)(a)(ii)

I have completed a preliminary risk assessment that is currently with Christel for clearance but the letter will be very helpful so please do send it through.

Are we able to provide you with the preliminary risk assessment before the end of the year in the first instance to help justify/guide the surveillance if it is for something that might pose a risk to public health and safety? Do we need to publish this online in the first instance or can it just be provided to you to help

decision making re surveillance? We can then also do up formal risk advice in the standard template for publication on the website in the new year?

s. 47F(1)s across this work and will be able to handle any questions and progress this for you in my absence.

And thank you for the data, that was extremely useful for the RA.

Happy holidays!

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology

s. 47F(1)

e: s. 47F(1) @foodstandards.gov.au

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Thursday, 15 December 2022 8:33 AM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>
Subject: RE: FDA recall enoki [SEC=OFFICIAL]

Hi s. 47F(1)

Thank you for the information.

I am in the process drafting a letter to request formal risk advise for enoki mushrooms.

Kind Regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 14 December 2022 4:54 PM
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.govt.nz>; s. 22(1)(a)(ii) @aff.gov.au>
Subject: FDA recall enoki [SEC=OFFICIAL]

OFFICIAL

FYI just came across this while finishing off advice. FDA recall enoki

https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts/utopia-foods-recalls-enoki-mushrooms-because-possible-health-risk#:~:text=Utopia%20Foods%20Inc%20of%20Glendale,in%20young%20children%2C%20frail%20or

s. 47F(1)
Senior Microbiologist | Food Safety and Microbiology
s. 47F(1)
@foodstandards.gov.au

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s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Tuesday, 16 May 2023 2:26 PM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: FOR REVIEW and COMMENT: Draft risk statement for Enoki Mushrooms and Listeria monocytogenes attached [SEC=OFFICIAL]

Hi s. 22(1)(a)(ii)

I've reviewed the risk advice. I have made numerous comments and I think it needs more work. Happy to meet with FSANZ to discuss, if needed. I'd also appreciate seeing another draft before it is finalised.

Thanks
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 15 May 2023 4:25 PM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>
Subject: FW: FOR REVIEW and COMMENT: Draft risk statement for Enoki Mushrooms and Listeria monocytogenes attached [SEC=OFFICIAL]

Good afternoon s. 22(1)(a)(ii)

For your review and comment: Draft enoki mushroom risk advice.

I have added all comments that have been discussed in the team meetings in the advice.
Once you have reviewed it I can send these to FANZ for finalisation.

Thank you so much (I understand you are pressed for time)
Appreciate everything that you do.

Kind regards
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Monday, 1 May 2023 11:53 AM
To: Imported Food Program <QEO-FoodSafetyUnit@agriculture.gov.au>
Subject: FOR REVIEW and COMMENT: Draft risk statement for Enoki Mushrooms and Listeria monocytogenes attached [SEC=OFFICIAL]

Good morning Team

We have received draft advice from FSANZ regarding enoki mushrooms and Listeria monocytogenes.
I have saved the draft advice here for your review and comments.

Could you get back to me by COB Friday (05 May 2023), it would be much appreciated.

Thank you
Kind regards
s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 27 April 2023 10:05 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: Draft risk statement for Enoki Mushrooms and Listeria monocytogenes attached [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Please find attached a draft risk statement for *Listeria monocytogenes* and enoki mushrooms for your consideration. I draw your attention to two comments in the document that I would appreciate comment on.

1. The scope of the statement was not agreed through the usual channels, so I have put something together in line with other statements. If you could check that the wording is appropriate for DAFF.
2. There is a lack of consumption data specifically for enoki mushrooms as opposed to general mushroom consumption which would be mainly button and portobello mushrooms and so I was wondering if it might be useful to consider import levels as a reflection of increasing use of enoki mushrooms. Would you be able to supply import data from 2010 to 2022?

I look forward to your comments in due course.

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

s. 47F(1)

@foodstandards.govt.nz

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s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 3 May 2023 7:50 AM
To: s. 22(1)(a)(ii)
Cc: s. 22(1)(a)(ii)
Subject: RE: Import data for enoki mushrooms [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Thanks for the information. Definitely a growing market in Australia judging by this data. I can add a statement into the risk statement to reflect this, given the lack of specific consumption data for enoki.

Regards
s. 47F(1)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Tuesday, 2 May 2023 4:30 pm
To: s. 47F(1) @foodstandards.gov.au>; s. 47F(1) @foodstandards.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: Import data for enoki mushrooms [SEC=OFFICIAL]

Good afternoon s. 47F(1)

The requested imported data for enoki mushrooms from 2010 – 2022 below.

Hope it helps.
Let me know if there is anything else that we can assist with.

Kind regards
s. 22(1)(a)(ii)

The below table shows import volume of fresh enoki mushrooms from 2010 – 2022.

Year	Quantity (kg)
2010	169,900.00
2011	192,242.00
2012	268,588.00
2013	298,289.15
2014	344,871.80
2015	446,321.10
2016	487,008.00
2017	657,982.00
2018	802,241.30
2019	1,437,640.66
2020	2,017,866.00
2021	2,047,910.87
2022	2,226,682.90
Grand Total	**11,397,543.78**

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 27 April 2023 10:05 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: Draft risk statement for Enoki Mushrooms and Listeria monocytogenes attached [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

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I look forward to your comments in due course.

Best Regards

s. 47F(1)

s. 47F(1) PhD (Cantab)

Senior Microbiologist | Food Safety and Microbiology Section

s. 47F(1)

@foodstandards.govt.nz

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s. 22(1)(a)(ii)

From: s. 47F(1) @foodstandards.gov.au>
Sent: Wednesday, 3 May 2023 9:31 AM
To: s. 22(1)(a)(ii)
Subject: RE: Import data for enoki mushrooms [SEC=OFFICIAL]

OFFICIAL

Hi s. 22(1)(a)(ii)

Both the old and new email addresses were in the original email and I received the email so must have gone through using the old email. We can continue using the old address for a few months so eventually things will sort themselves out……at least I hope so!

s. 47F(1)

From: s. 22(1)(a)(ii) @aff.gov.au>
Sent: Wednesday, 3 May 2023 11:05 am
To: s. 47F(1) @foodstandards.gov.au>
Subject: FW: Import data for enoki mushrooms [SEC=OFFICIAL]

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good morning s. 47F(1)

Forwarding the email I sent to you yesterday regarding the import data.
Apparently your new email add (s. 47F(1) @foodstandards.gov.au) has been quarantined by DAFF. That might take a while to unlock.
So sending it again at your previous account.

Apologies if you have already received it.

Cheers
s. 22(1)(a)(ii)

From: s. 22(1)(a)(ii)
Sent: Tuesday, 2 May 2023 2:30 PM
To: s. 47F(1) @foodstandards.govt.nz>; s. 47F(1) @foodstandards.gov.au
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
Subject: Import data for enoki mushrooms [SEC=OFFICIAL]

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2021	2,047,910.87
2022	2,226,682.90
Grand Total	**11,397,543.78**

From: s. 47F(1) @foodstandards.govt.nz>
Sent: Thursday, 27 April 2023 10:05 AM
To: s. 22(1)(a)(ii) @aff.gov.au>
Cc: s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) @aff.gov.au>; s. 22(1)(a)(ii) <s. 22(1)(a)(ii)@aff.gov.au>; s. 47F(1) @foodstandards.gov.au>
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I look forward to your comments in due course.

Best Regards

s. 47F(1)

s. 47F(1)

Senior Microbiologist | Food Safety and Microbiology Section

t: +s. 47F(1)

@foodstandards.govt.nz

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