



**JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX COMMITTEE ON FOOD HYGIENE
Fifty-second Session**

Virtual

28 February – 4 March and 9 March 2022

MATTERS ARISING FROM THE WORK OF FAO AND WHO (including JEMRA)

Prepared by FAO and WHO

Introduction

1. This paper describes the scientific advice as well as related information and resources that the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) have developed relevant to the specific agenda items of the 52nd Session of the Codex Committee on Food Hygiene (CCFH).

A) RECENT FAO/WHO ACTIVITIES RELEVANT TO THE ONGOING WORK OF CCFH

A.1 Shiga toxin-producing *Escherichia coli* (STEC) associated with meat and dairy products (Relevant to Agenda Item 7)

2. The CCFH has discussed the importance of STEC in foods since its 45th Session¹. Following a request from the 47th Session in November 2015², the FAO and WHO published the Shiga toxin-producing *Escherichia coli* (STEC) and food: attribution, characterization and monitoring report in 2018 (MRA31)³. As part of the 50th session of CCFH in November 2018, the FAO/WHO updated the committee on the findings published within the Attributing illness caused by Shiga toxin-producing *Escherichia coli* (STEC) to specific foods report in 2019 (MRA32)⁴.

3. Having identified foods most frequently associated with illness, the Codex Alimentarius Commission (CAC) approved new work at the 42nd Session, July 2019, on the development of guidelines for the control of STEC in beef, raw milk and cheese produced from raw milk, leafy greens and sprouts⁵. To support this work, the JEMRA convened two meetings addressing Shiga toxin-producing *Escherichia coli* (STEC).

4. The expert meeting on STEC held virtual from 1 to 26 June 2020 discussed the approach to evaluate the scientific evidence, and focused on control of STEC in live animals and foods of animal origin, including beef and dairy from primary production, processing to post-processing. Other topics like STEC monitoring and detection were also discussed. The executive summary was shared with the EWG Chairs through the Codex secretariat after the JEMRA meeting. The meeting report is in development.

5. For information on STEC in leafy greens and sprouts, please also see section A2.

Follow-up action by CCFH

6. CCFH is invited to consider the information provided and advise on any outstanding scientific advice needs the Committee may find still unaddressed on this topic.

A.2 Prevention and control of microbiological hazards in fresh fruits and vegetables (Relevant to Agenda Item 7)

7. In 2019, following a request from the CCFH, the CAC approved new work at its 42nd Session on the development of guidelines for the control of STEC in leafy greens and in sprouts⁵. Moreover, other JEMRA

¹ [Report of the 45th session of CCFH](#)

² [Report of the 47th session of CCFH](#)

³ MRA31: <https://www.fao.org/3/ca0032en/ca0032en.pdf> and <https://www.who.int/publications-detail-redirect/9789241514279>

⁴ MRA32: <http://www.fao.org/3/ca5758en/ca5758en.pdf> and <https://www.who.int/publications/item/9789241516396>

⁵ [Report of the 50th session of CCFH](#)

meetings reported fresh fruits and vegetables as emerging causes of foodborne illness: Shiga toxin-producing *Escherichia coli* (STEC) and food: attribution, characterization and monitoring (MRA31)³; JEMRA meeting on *L. monocytogenes* in ready-to-eat (RTE) foods (October 2020) noted increased reports of listeriosis acquired from fresh and minimally processed fruits and vegetables. To meet the requests of the CCFH, to update and expand the information available in older JEMRA document, *Microbial hazards in fresh leafy vegetables and herbs* (MRA14)⁶, and to fill recognized information gaps on the microbiological safety of fresh fruits and vegetables, FAO and WHO planned and convened a series of expert meetings on preventing and controlling microbiological hazards in these products.

8. The virtual JEMRA meetings on fresh fruit and vegetable safety were convened on 26 and 28 July, from 20 September to 1 October with an additional day on 4 October 2021. The purpose of the meetings was to collect, review and discuss relevant measures for control of microbiological hazards from primary production to point-of-sale in fresh, ready-to-eat and minimally processed fruits and vegetables, including leafy vegetables.

9. The experts discussed (1) the definition of the relevant terms; (2) food-borne illness, microbiological hazards, commodities of concern, overview of production systems and the international production and trade; (3) primary production in open fields; (4) primary production in protected facilities; (5) minimal processed; and (6) transport, distribution and point-of-sale. Given that fruit and vegetable production includes many commodities grown in diverse geographic regions that are often distributed globally, the experts agreed that it is unlikely there will be sufficient research data to clearly identify all hazards or define practices to reduce all associated risks. Acknowledging these challenges, the experts identified research areas that would be most valuable for study in the full report, including both hazard identification and mitigation interventions. **For more information on the control of microbiological hazards in fresh fruits and vegetables, please kindly find the published summary report⁷.**

10. A subsequent virtual meeting (Part 3, Sprouts) was convened on 22, 23, 24, 29 and 30 November 2021. The purpose of the meeting was to collect, review and discuss relevant measures for control of microbiological hazards in sprouts, from the production of seeds for sprouting, to the production of sprouts and point-of-sale.

11. The experts discussed the (1) definition of the relevant terms; (2) microbiological hazards in sprouts; (3) prevention and control measures for seed production and handling; (4) prevention and control measures for sprout production; (5) prevention and control measures during distribution and point-of-sale; (6) Records and Traceability; and (7) training. **For more information on the control of microbiological hazards in sprouts, please kindly find the published summary report⁸.**

12. A subsequent meeting is scheduled to be held in 2022 and will focus on other commodity-specific recommendations (also see section B1).

Follow-up action by CCFH

13. CCFH is invited to consider the aforementioned information in determining the next steps to address foodborne STEC as well as the other microbiological hazards in fresh fruits and vegetables. This information may be useful in the review of the “Code of hygienic practice for fresh fruits and vegetables” initially developed in 2003, then later revised it following a JEMRA meeting, held in 2008. Several commodity specific annexes were added to the code of practice in 2012, 2013, and 2017.

A.3 *Listeria monocytogenes*

14. A virtual meeting of the JEMRA of *Listeria monocytogenes* in ready-to-eat (RTE) food, attribution, characterization, and monitoring, was held from 20 October to 6 November 2020. The purpose of the meeting was to review recent data on *L. monocytogenes* and determine the need to modify, update, or develop new risk assessment models and tools for this pathogen.

15. The expert group recommended to extend future risk assessments to diverse commodity sub-groups and to consider farm-to-fork risk assessment. The expert group also recommended that future risk assessments should review groupings of susceptible populations based on physiological risks and other socio-economic factors. In conclusion, the expert group identified several critical gaps in the current FAO/WHO risk assessment model and collectively agreed that updating the model would be valuable for informing risk

⁶ MRA14: <https://www.fao.org/3/i0452e/i0452e.pdf> and <https://www.who.int/publications/i/item/9789241563789>

⁷ <https://www.fao.org/3/cb7664en/cb7664en.pdf> and <https://www.who.int/news-room/events/detail/2021/07/12/default-calendar/joint-fao-who-expert-meeting-on-the-prevention-and-control-of-microbiological-hazards-in-fresh-fruits-and-vegetables>

⁸ <https://www.fao.org/3/cb8201en/cb8201en.pdf> and <https://www.who.int/news-room/events/detail/2021/07/12/default-calendar/joint-fao-who-expert-meeting-on-the-prevention-and-control-of-microbiological-hazards-in-fresh-fruits-and-vegetables>

analysis strategies, including in low- and middle-income countries (LMICs). **For more information on *L. monocytogenes*, please kindly find the published summary report⁹.** The meeting report will be published shortly.

Follow-up action by CCFH

16. CCFH is invited to consider the information provided and evaluate the necessity to update the *Guidelines on the Application of General Principles of Food Hygiene to the Control of Listeria Monocytogenes in Foods* (CXG 61-2007).

A.4 Safety and quality of water used in the production of fishery and dairy products (Relevant to Agenda Item 8)

17. In 2020, the 43rd session of CAC approved the new work entitled “Development of Guidelines for the Safe Use and Reuse of Water in Food Production” proposed at the 51st Session of the CCFH¹⁰. To support this work, FAO and WHO were asked to provide scientific advice on sector-specific applications and case studies for determining appropriate and fit-for-purpose microbiological criteria for water sourcing, use and reuse in: (1) fresh produce, (2) fish and fishery products from primary production to retail, and (3) in the dairy sector from milk harvest to manufacturing. As the 2019 JEMRA meeting already addressed the issue in fresh produce (the meeting report was published as MRA37¹¹), the 2021 meetings focused on the quality and safety of water used and re-used in fish and dairy sectors as outlined below.

Fishery

18. A virtual JEMRA meeting on the safety and quality of water used in the production of fishery products was convened from 14 June to 2 July 2021 with three additional sessions on 29 July, 30 August, and 14 October 2021. The experts discussed: (1) situation analysis concerning water use and reuse in the production and processing of fishery products; (2) analysis of case studies for different risk-based water use and reuse processing scenarios and species; and (3) water quality monitoring and the use of non-culture based microbiological methods. **For more information on water quality in fishery products, please kindly find the published summary report¹².** The meeting report is in development.

Dairy

19. A virtual JEMRA meeting on the safety and quality of water use and reuse in the dairy sector was convened from 14 June to 2 July 2021 with one additional session on 8 July 2021. The experts discussed: (1) situation analysis concerning water use and reuse in the dairy sector; (2) the implementation of water reuse in dairy operations; and (3) testing and microbiological parameters concerning the implementation of water reuse in dairy operations. **For more information on water quality in dairy products, please kindly find the published summary report¹³.** The meeting report is in development.

Follow-up action by CCFH

20. CCFH is invited to consider the information provided and advise on any outstanding scientific advice needs the Committee may find still unaddressed on this topic.

A.5 Risk assessment of food allergens

21. The CCFH has developed Code of Practice on Food Allergen Management for Food Business Operators (CXC 80-2020) (CoP), which was adopted in 2020. This CoP provides guidance on allergen management in food production, including controls to prevent cross-contact where an allergen is inadvertently transferred from a food containing an allergen to a food that does not contain the allergen¹⁴. The General Principles of Food Hygiene (GPFH) have also been updated in 2020 and include information on the control of allergens¹⁵. The CoP is intended to complement the GPFH and the *General standard for the labelling of pre-packaged foods* (CXS 1-1985) (GSLPF) and support industry compliance. Simultaneously, the Codex Committee on Food

⁹ <https://www.fao.org/3/cb3061en/cb3061en.pdf> and [https://www.who.int/news-room/events/detail/2020/10/20/default-calendar/joint-fao-who-expert-meeting-on-microbiological-risk-assessment-of-listeria-monocytogenes-in-ready-to-eat-\(rte\)](https://www.who.int/news-room/events/detail/2020/10/20/default-calendar/joint-fao-who-expert-meeting-on-microbiological-risk-assessment-of-listeria-monocytogenes-in-ready-to-eat-(rte))

¹⁰ [Report of the 51st session of CCFH](#)

¹¹ MRA37 <https://www.fao.org/3/cb7678en/cb7678en.pdf> and <https://www.who.int/publications/i/item/9789240030220>

¹² <https://www.fao.org/3/cb7395en/cb7395en.pdf> and <https://www.who.int/news-room/events/detail/2021/06/14/default-calendar/joint-fao-who-expert-meeting-on-the-microbiological-safety-and-quality-of-water-used-in-the-production-of-fishery-and-dairy-products>

¹³ <https://www.fao.org/3/cb7539en/cb7539en.pdf> and <https://www.who.int/news-room/events/detail/2021/06/14/default-calendar/joint-fao-who-expert-meeting-on-the-microbiological-safety-and-quality-of-water-used-in-the-production-of-fishery-and-dairy-products>

¹⁴ [CXC 80 - Code of practice on food allergen management for food business operators](#)

¹⁵ [CXC 1 – General principle of food hygiene](#)

Labelling (CCFL) is reviewing provisions relevant to allergen labelling in the GSLPF as well as developing guidance on the use of precautionary allergen or advisory labelling (PAL)¹⁶.

22. Food allergens are of significant importance to public health. There have been many scientific developments in the understanding of food allergens and their management since the original drafting of the GSLPF. Thus, in response to the request from Codex for scientific advice, including current evidence of consumer understanding of allergens, FAO and WHO convened a series of three expert meetings to provide scientific advice on this subject.

Part 1: Review and validation of Codex priority allergen list through risk assessment

23. An ad hoc joint FAO/WHO expert consultation was convened from 30 November to 11 December 2020, with two additional days on 28 January and 8 February 2021. The objectives of this meeting were to address the following request for scientific advice:

- Whether the published criteria for assessing additions and exclusions to the list is still current and appropriate.
- Subject to the advice on the criteria above:
 - Whether there are foods and ingredients that should be added to or deleted from the list.
 - Clarification of the groupings of foods and ingredients in the list.
 - Whether certain foods and ingredients, such as highly refined foods and ingredients, that are derived from the list of foods known to cause hypersensitivity can be exempted from mandatory declaration.

24. Food or ingredient hypersensitivity is an issue of significant importance in public health. In order to properly address this issue, it is important to differentiate the different categories of hypersensitivity. Hypersensitivity reactions to foods or food ingredients include food allergies, food intolerances, and other adverse reactions. Food allergy refers to an adverse health effect arising from a specific immune-mediated response to a specific food allergen, which is different from food intolerance where the adverse reaction is the result of a non-immunological adverse response.

25. Considering all scientific evidence and expert opinions, the expert committee decided that it would limit its deliberation to only those foods or ingredients that cause Ig-E mediated reaction and foods, or ingredients involved in coeliac disease.

26. A total of 26 foods or food groups falling in these two groups were identified by the expert committee and were classified based on a semi-quantitative risk ranking model that considers three main criteria (prevalence, potency and severity). As a result, the expert committee did not recommend keeping soybean on the global list due to its low global prevalence, allergenic potency as well as observed severity. Yet, due to its widespread use in food products, the committee recommended to consider keeping soybean on a list of allergens for potential regional consideration.

27. Based on systematic and thorough assessments which used all three criteria (prevalence, severity and potency), the expert committee recommended that the following should be listed as global priority allergens: cereals containing gluten (i.e. wheat and other *Triticum* species, rye and other *Secale* species, barley and other *Hordeum* species and their hybridized strains), crustacea, eggs, fish, milk, peanuts, sesame, specific tree nuts (almond, cashew, hazelnut, pecan, pistachio and walnut). Due to the lack of data on prevalence, severity and/or potency, or due to regional consumption of some foods, the expert committee recommended that some other allergens should not be listed as global priority allergens but may be considered for inclusion on priority allergen lists in individual countries. Since current dietary trends include an increased consumption of plant-based foods and diets consisting of alternative protein sources, it was recommended that pulses, insects and other foods be included in a “watch list” and evaluated for the priority allergen list when data on prevalence, severity and potency become available. Finally, the expert committee recommended that foods and ingredients derived from the list of foods known to cause immune-mediated hypersensitivities should be evaluated on a case-by-case basis for exclusion from declaration on ingredient lists and/or on food packaging.

28. **A summary report was published¹⁷.** The meeting report will be published shortly.

Part 2: Review and establish threshold levels in foods of the priority allergens

29. The objectives of the expert consultation was to provide scientific advice to address the following:

- What are the threshold levels for the priority allergens below which the majority of allergic consumers would not suffer an adverse reaction?
- For the priority allergens, what are appropriate analytical methods for testing food and surfaces?

¹⁶ REP19/FL and REP21/FL

¹⁷ <https://www.fao.org/3/cb4653en/cb4653en.pdf> and <https://www.who.int/news-room/events/detail/2020/11/30/default-calendar/ad-hoc-joint-fao-who-expert-consultation-on-risk-assessment-of-food-allergens-part1>

- What should be the minimum performance criteria for these different analytical methods?

30. Thus, FAO and WHO re-convened the *ad hoc* joint FAO/WHO expert consultation on risk assessment of food allergens for a second meeting to provide scientific advice on this subject. The virtual meeting was convened from 15 March to 2 April 2021. **A summary report was published¹⁸**. The meeting report is in development.

Part 3: Review and establish precautionary labelling in foods of the priority allergens

31. The purpose of this third meeting was to evaluate the evidence in support of precautionary labelling to provide scientific advice to address the following:

- What methods/tools are available for FBOs to determine:
 - whether allergen cross-contact is reasonably likely to occur in a food after a cleaning procedure;
 - whether allergen cross-contact is reasonably likely to occur from equipment used for foods with different allergen profiles; and
 - the level of allergen in a food resulting from cross-contact?
- Guidance on precautionary labelling.
 - The use of scientifically based threshold levels to evaluate risk for consumers with food allergies.
 - Determine the conditions for using the precautionary allergen labelling.
- How can thresholds be used by FBOs to determine:
 - the extent to which a cleaning procedure removes an allergen to a level that prevents or minimises the risk to the majority of allergic consumers from allergen cross-contact; and
 - whether an ingredient that contains a low level of an allergen (e.g. an ingredient with a precautionary allergen label) warrants control of its use to prevent or minimise allergen cross-contact?

32. An *ad hoc* joint FAO/WHO expert consultation was convened from 18 to 29 October, with an additional day on 3 November 2021. **A summary report was published¹⁹**. The meeting report is in development.

Follow-up action by CCFH

33. CCFH is invited to consider the aforementioned information in determining the next steps to address food allergens.

A.6 Foodborne Disease Burden Epidemiology Reference Group (FERG) and International Food Safety Authorities Network (INFOSAN) (Relevant to Agenda Item 5)

Burden of foodborne diseases

34. WHO reestablished in May 2021 its advisory group, “Foodborne Disease Burden Epidemiology Reference Group (FERG)”²⁰ with 26 new members to serve for 3 years from 2021 until 2024 with a specific terms of reference.²¹ Two expert meetings were organized in July and October 2021 respectively, and discussed a three-year strategic framework on three main activities, including (1) estimating the global burden of foodborne diseases, (2) providing country supports on the national estimation of foodborne disease burden, and (3) developing a methodology to monitor progress against the new global food safety strategy with appropriate indicators and targets.

35. WHO published in June 2021 a new handbook that helps Member States assess causes, magnitude and distribution of foodborne diseases.²² The handbook aims to provide detailed guidance on assessing the burden of foodborne diseases, and aims to promote national studies in order to better allocate resources efficiently to prevention, intervention and control measures. English, French and Spanish versions are already available, and the Russian version is underway for its publication later in 2021. Executive summary is available in all 6 UN languages.

¹⁸ <https://www.fao.org/3/cb6388en/cb6388en.pdf> and <https://www.who.int/news-room/events/detail/2021/03/15/default-calendar/ad-hoc-joint-fao-who-expert-consultation-on-risk-assessment-of-food-allergens-part2-review-and-establish-threshold-levels-in-foods-of-the-priority-allergens>

¹⁹ <https://www.fao.org/3/cb7971en/cb7971en.pdf> and <https://www.who.int/news-room/events/detail/2021/10/18/default-calendar/ad-hoc-joint-fao-who-expert-consultation-on-risk-assessment-of-food-allergens-part-3-review-and-establish-precautionary-labelling-in-foods-of-the-priority-allergens>

²⁰ [https://www.who.int/groups/foodborne-disease-burden-epidemiology-reference-group-\(ferg\)](https://www.who.int/groups/foodborne-disease-burden-epidemiology-reference-group-(ferg))

²¹ https://cdn.who.int/media/docs/default-source/food-safety/call-for-experts/tor-for-reference-ferg-31aug2020.pdf?sfvrsn=b0a3d1f_8

²² <https://www.who.int/publications-detail-redirect/9789240012264>

Early warning/alert, preparedness and response to food safety incidents

36. The Secretariat of the joint FAO/WHO International Food Safety Authorities Network (INFOSAN)²³, continues to develop and strengthen the Network and develop capacity for preparedness and response to food safety incidents. In 2021, INFOSAN facilitated the exchange of information during 246 international food safety incidents.

37. Efforts to strengthen partnerships with a variety of regional authorities and networks have continued in 2021. INFOSAN members' knowledge and capabilities to participate actively in the Network and respond effectively to food safety emergencies has been further developed through the delivery of several national and subregional webinars and workshops. Additionally, the INFOSAN Secretariat also supported a national initiative on a Codex Advocacy Workshop "Achieving leadership in the Codex Process" with Bhutan. Furthermore, to support this work, through the Resource Spotlight Initiative, the INFOSAN Secretariat continues to disseminate on a monthly basis FAO/WHO guidance documents on food safety to INFOSAN members.

38. In 2021, an IHR-INFOSAN simulation exercise was organized for Member States in Africa targeting INFOSAN Emergency Contact Points and National IHR Focal Points. In addition, a risk communication workshop was held with Portuguese speaking countries in Africa.

39. In 2021, activities to strengthen the network at the regional level were undertaken, such as the eighth meeting of INFOSAN members in the Americas, the first Regional Meeting of INFOSAN members in Africa and a Regional Meeting of INFOSAN in Asia, which were held virtually. The INFOSAN Secretariat also participated in a sub-regional workshop with the Western Balkan and similarly with Member States in South East Asia. Support was also provided by the INFOSAN Secretariat for the WHO South East Asian Regional Roundtable Meeting (Virtual) to Advance Implementation of the Framework for Action on Food Safety. In addition, the INFOSAN Secretariat, with the support of the Canadian Food Inspection Agency, has organized an INFOSAN Train-the-trainer Workshop. The workshop successfully prepared 11 new INFOSAN ambassadors members to be placed on a roster and deployed in the future online or in-person targeted training of other INFOSAN members.

40. In July 2021, the INFOSAN Secretariat launched the new INFOSAN Community Website (ICW) with new and improved functionalities that will facilitate communication and information sharing during international food safety incidents. The new INFOSAN Community Website has more than 700 members from over 190 WHO Member States and their territories.

41. An initiative of holding INFOSAN working group sessions by topical thematic areas initiated in 2020 proved very successful and there is a request for continuation of this series of workshops in 2021. The thematic areas discussed include (i) additional food safety measures during COVID-19 pandemic, (ii) management of allergens in international food trade; (iii) food recalls in the context of international trade; (iv) crisis communication; (v) dietary/food supplements.

42. The INFOSAN Secretariat supported the Global Food Safety Incidents and Emergency Response Conference, organized and hosted by the Food Standards Agency (FSA) and Food Standards Scotland (FSS) of the United Kingdom.

B) OTHER RELATED ISSUES

B.1 Food commodities of fresh fruits and vegetable

43. In addition to the scientific advice requested directly, the FAO/WHO secretariat has been working to update and expand the information available on the microbiological hazards in fresh leafy vegetable and herbs (MRA14)⁶. This focus of this work is to investigate and re-evaluate whether the underlying scientific evidence for the Codex Code of hygienic practice for fresh fruits and vegetable and its commodity-specific annexes is still relevant and up-to-date.

B.2 Next generation of microbiological risk assessment

44. In addition to the scientific advice requested directly, the FAO/WHO secretariat has been working to update the existing methodologies for risk assessment, taking into account new developments and rapidly increasing molecular big data, namely the omics (genomics, transcriptomics, proteomics and metabolomics). This is a mission-critical effort to assure that the scientific advice provided is always based on current methodologies and the latest scientific knowledge. In this context, the review and discussions on this next

²³ <https://www.who.int/groups/fao-who-international-food-safety-authorities-network-infosan/about>

generation microbiological risk assessment are under way. The work will continue over the next 1 to 3 years. Regular updates will be provided to the Committee.

C) PUBLICATIONS

45. All the publications in Microbiological Risk Assessment (MRA) Series are available on the FAO (<https://www.fao.org/food-safety/resources/publications/en/>) and WHO ([https://www.who.int/groups/joint-fao-who-expert-meetings-on-microbiological-risk-assessment-\(jemra\)](https://www.who.int/groups/joint-fao-who-expert-meetings-on-microbiological-risk-assessment-(jemra))) websites.

46. Recent publications:

- FAO and WHO. 2020. Risk assessment tools for *Vibrio parahaemolyticus* and *Vibrio vulnificus* associated with seafood: meeting report. Microbiological Risk Assessment Series No. 20. Available at: <https://www.fao.org/3/ca7240en/CA7240EN.pdf> and <https://www.who.int/publications/i/item/9789240000186>
- FAO and WHO. 2020. Risk-based examples and approach for control of *Trichinella* spp. and *Taenia saginata* in meat, revised edition. Microbiological Risk Assessment Series No. 25. Available at: <https://www.fao.org/3/cb1672en/CB1672EN.pdf> and <https://www.who.int/publications/i/item/9789240012431>
- FAO and WHO. 2021. Microbial safety of lipid-based ready-to-use foods for management of moderate acute malnutrition and severe acute malnutrition – second report. Microbiological Risk Assessment Series No. 29. Available at: <https://www.fao.org/3/cb3223en/cb3223en.pdf> and <https://www.who.int/publications/i/item/9789240019904>
- FAO and WHO. 2019. Role of the environment, crops and biocides: meeting report. Microbiological Risk Assessment Series No. 34. Available at: <https://www.fao.org/3/ca6724en/CA6724EN.pdf> and <https://www.who.int/publications/i/item/9789241516907>
- FAO and WHO. 2021. Advances in science and risk assessment tools for *Vibrio parahaemolyticus* and *V. vulnificus* associated with seafood: meeting report. Microbiological Risk Assessment Series No. 35. Available at: <https://www.fao.org/3/cb5834en/cb5834en.pdf> and <https://www.who.int/publications/i/item/9789240024878>
- FAO and WHO. 2021. Microbiological risk assessment - guidance for food. Microbiological Risk Assessment Series No. 36. Available at: <https://www.fao.org/3/cb5006en/cb5006en.pdf> and <https://www.who.int/publications/i/item/9789240024892>
- FAO and WHO. 2021. Safety and quality of water used with fresh fruits and vegetables. Microbiological Risk Assessment Series No. 37. Available at: <https://www.fao.org/3/cb7678en/cb7678en.pdf> and <https://www.who.int/publications/i/item/9789240030220>
- FAO and WHO. 2021. In brief: Assessing the risk of microbiological hazards in foods.
 - Arabic, <http://www.fao.org/documents/card/ar/c/cb4709ar>
 - Chinese, <http://www.fao.org/documents/card/zh/c/cb4709zh>
 - English, <http://www.fao.org/documents/card/en/c/cb4709en>
 - French, <http://www.fao.org/documents/card/fr/c/cb4709fr>
 - Russian, <http://www.fao.org/documents/card/ru/c/cb4709ru>
 - Spanish, <http://www.fao.org/documents/card/es/c/cb4709es>
 - <https://www.who.int/publications/m/item/in-brief-assessing-the-riskof-microbiological-hazards-in-foods>
- FAO and WHO. 2021. Microbiological Risk Assessment (MRA) for Food (Infographic).
 - Arabic, <http://www.fao.org/3/cb5037ar/cb5037ar.pdf>
 - Chinese, <http://www.fao.org/3/cb5037zh/cb5037zh.pdf>
 - English, <http://www.fao.org/3/cb5037en/cb5037en.pdf>
 - French, <http://www.fao.org/3/cb5037fr/cb5037fr.pdf>
 - Russian, <http://www.fao.org/3/cb5037ru/cb5037ru.pdf>
 - Spanish, <http://www.fao.org/3/cb5037es/cb5037es.pdf>
 - [https://www.who.int/multi-media/details/microbiological-risk-assessment-\(mra\)-for-food](https://www.who.int/multi-media/details/microbiological-risk-assessment-(mra)-for-food)
- FAO. 2020. FAO guide to ranking food safety risks at the national level. Food Safety and Quality Series No 10. Rome. <https://doi.org/10.4060/cb0887en>

- FAO and WHO. 2021. Technical guidance for the development of the growing area aspects of bivalve mollusc sanitation programmes, Second edition. Available at <https://www.fao.org/documents/card/en/c/cb5072en> (English), <https://www.fao.org/publications/card/en/c/CB5072ES> (Spanish) and <https://www.who.int/publications/i/item/9789240030213> (English), <https://www.who.int/es/publications/i/item/9789240030213> (Spanish)
 - The summary report of ad hoc joint FAO/WHO expert consultation on risk assessment of food allergens, part 1: review and validation of Codex Alimentarius priority allergen list through risk assessment. Available at: <https://www.fao.org/3/cb4653en/cb4653en.pdf> and <https://www.who.int/news-room/events/detail/2020/11/30/default-calendar/ad-hoc-joint-fao-who-expert-consultation-on-risk-assessment-of-food-allergens-part1>
 - The summary report of ad hoc joint FAO/WHO expert consultation on risk assessment of food allergens, part 2: review and establish threshold levels in foods for the priority allergens. Available at: <https://www.fao.org/3/cb6388en/cb6388en.pdf> and <https://www.who.int/news-room/events/detail/2021/03/15/default-calendar/ad-hoc-joint-fao-who-expert-consultation-on-risk-assessment-of-food-allergens-part2-review-and-establish-threshold-levels-in-foods-of-the-priority-allergens>
 - The summary report of ad hoc Joint FAO/WHO expert consultation on risk assessment of food allergens, part 3: review and establish precautionary labelling in foods of the priority allergens. Available at: <https://www.fao.org/3/cb7971en/cb7971en.pdf> and <https://www.who.int/news-room/events/detail/2021/10/18/default-calendar/ad-hoc-joint-fao-who-expert-consultation-on-risk-assessment-of-food-allergens-part-3-review-and-establish-precautionary-labelling-in-foods-of-the-priority-allergens>
 - The summary report of JEMRA meeting on the safety and quality of water used in the production of fishery products. Available at: <https://www.fao.org/3/cb7395en/cb7395en.pdf> and <https://www.who.int/news-room/events/detail/2021/06/14/default-calendar/joint-fao-who-expert-meeting-on-the-microbiological-safety-and-quality-of-water-used-in-the-production-of-fishery-and-dairy-products>
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 - The summary report of JEMRA meeting on the prevention and control of microbiological hazards in fresh fruits and vegetables (part 1 and part 2, general principle and fresh fruits and vegetables). Available at: <https://www.fao.org/3/cb7664en/cb7664en.pdf> and <https://www.who.int/news-room/events/detail/2021/07/12/default-calendar/joint-fao-who-expert-meeting-on-the-prevention-and-control-of-microbiological-hazards-in-fresh-fruits-and-vegetables>
 - The summary report of JEMRA meeting on the prevention and control of microbiological hazards in fresh fruits and vegetables (part 3, sprouts). Available at: <https://www.fao.org/3/cb7971en/cb7971en.pdf> and <https://www.who.int/news-room/events/detail/2021/07/12/default-calendar/joint-fao-who-expert-meeting-on-the-prevention-and-control-of-microbiological-hazards-in-fresh-fruits-and-vegetables>
 - The summary report of JEMRA meeting on Microbiological Risk Assessment of *Listeria monocytogenes* in Ready-to-Eat (RTE) Food: Attribution, Characterization and Monitoring. Available at: <https://www.fao.org/3/cb3061en/cb3061en.pdf> and [https://www.who.int/news-room/events/detail/2020/10/20/default-calendar/joint-fao-who-expert-meeting-on-microbiological-risk-assessment-of-listeria-monocytogenes-in-ready-to-eat-\(rte\)](https://www.who.int/news-room/events/detail/2020/10/20/default-calendar/joint-fao-who-expert-meeting-on-microbiological-risk-assessment-of-listeria-monocytogenes-in-ready-to-eat-(rte))
47. Peer-reviewed external publications
- Jeffrey T. LeJeune, Kang Zhou, Christine Kopko and Haruka Igarashi. 2021. FAO/WHO Joint Expert Meeting on Microbiological Risk Assessment (JEMRA): Twenty Years of International Microbiological Risk Assessment. *Foods*, 10: 1873. <https://doi.org/10.3390/foods10081873>
48. Forthcoming publications include:
- Ranking of low moisture foods in support of microbiological risk management: meeting report and systematic review. Microbiological Risk Assessment Series No. 26. In press to be released in 2022.

- Microbiological hazards in spices and dried aromatic herbs: meeting report. Microbiological Risk Assessment Series No. 27. In press to be released in 2022.
- *Listeria monocytogenes* in ready-to-eat (RTE) food: attribution, characterization and monitoring: meeting report. Microbiological Risk Assessment Series No. 38. In press to be released in 2022.
- Control measures for Shiga toxin-producing *Escherichia coli* (STEC) associated with meat and dairy products: meeting report. Microbiological Risk Assessment Series No. 39. In press to be released in 2022.
- Safety and quality of water used with fishery products: meeting report. Microbiological Risk Assessment Series No. 40. In press to be released in 2022.
- Safety and quality of water used with dairy products: meeting report. Microbiological Risk Assessment Series No. 41. In press to be released in 2022.
- Prevention and control of microbiological hazards in fresh fruits and vegetables (Part 1 and Part 2, general principle and fresh fruits and vegetables). Meeting Report. Microbiological Risk Assessment Series No 42.
- Prevention and control of microbiological hazards in fresh fruits and vegetables (Part 3, sprouts). Meeting Report. Microbiological Risk Assessment Series No 43.
- Risk assessment of food allergens, part 1: review and validation of Codex Alimentarius priority allergen list through risk assessment: meeting report. Food Safety and Quality Series No 14. In press to be released in 2022.
- Risk assessment of food allergens, part 2: review and establish threshold levels in foods for the priority allergens: meeting report. Food Safety and Quality Series No 15. In press to be released in 2022.
- Risk assessment of food allergens, part 3: review and establish precautionary labelling in foods of the priority allergens. Food Safety and Quality Series No 16. In press to be released in 2022.