Food and Agriculture Organization of the United Nations

World Health Organization

Ad hoc Joint FAO/WHO Expert Consultation on Risk Assessment of Food Allergens – reference dose(s) for cereals containing gluten or gluten

FAO HQ, Rome, Italy: 3 – 7 November 2025

SUMMARY AND CONCLUSIONS

Issued in November 2025

In response to the request from Codex Committee on Food Labelling (CCFL) for scientific advice on reference dose(s) (RfDs) and concentration for gluten and cereals containing gluten, FAO and WHO convened an expert consultation to provide recommendation on the level of RfDs and concentration for gluten and cereals containing gluten.

FAO and WHO Risk Assessment of Food Allergens. Part 1 – Review and validation of Codex Alimentarius priority allergen list through risk assessment[1], contains details about coeliac disease and IgE-mediated allergies to cereals containing gluten.

This current document summarizes the conclusions of this meeting and is made available to facilitate the deliberations of the CCFL and Codex Committee on Food Hygiene (CCFH). The full report of the meeting will be published as part of the Food Safety and Quality Series.

The meeting participants are listed in Annex 1 of this summary report. Melanie Downs served as Chairperson and Jason Tye-Din as Rapporteur.

More information on this work is available at:

http://www.fao.org/food-safety/en/

and

https://www.who.int/foodsafety/en/

[1] FAO and WHO. 2022. *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. Rome. https://doi.org/10.4060/cb9070en

Coeliac disease

- Coeliac disease is a chronic, immune-mediated (non-IgE) intestinal and systemic disease in genetically predisposed individuals induced by exposure to dietary gluten proteins that come from wheat, rye, and barley.
    - For individuals with coeliac disease, sustained ingestion of gluten is associated with small intestinal mucosal damage and an increased risk of a range of adverse health outcomes.
    - In addition to chronic intestinal injury, gluten can also trigger acute symptoms in individuals with coeliac disease otherwise adhering to a gluten-free diet, that adversely impact their quality of life.
    - A strict and lifelong gluten-free diet is currently the only treatment for coeliac disease and can heal the mucosa and reverse symptoms, but this is reliant on strict removal of dietary gluten. Ongoing gluten exposure, including through inadvertent exposures, are a cause of persistent mucosal damage in individuals with coeliac disease.
    - There is a lack of controlled chronic exposure studies that use mucosal damage as the primary endpoint for determining safe gluten intake in coeliac disease. Furthermore, studies correlating mucosal damage and long-term adverse health effects are limited and may not reflect real-world risk.

- Individuals with coeliac disease can be exposed to gluten through a variety of sources including undeclared ingredients in packaged foods or food service operations, cross-contact in packaged foods, and contamination occurring during food preparation.
    - Access to affordable, available, and safe food options is important for individuals with coeliac disease.
    - One of the concerns with current labelling practices is the confusing use of gluten-free and precautionary allergen labelling (PAL) statements for cereals containing gluten on the same product.

- In 2008, Codex Alimentarius Commission established that gluten-free foods should contain levels of gluten no higher than 20 mg/kg [CXS-118][2]. With a daily intake of 500 g of food with levels of gluten no higher than 20 mg/kg, this would equate to an intake of no more than 10 mg of gluten per day.
    - This level was primarily informed by a single, double-blind randomised controlled trial which showed that 50 mg of gluten daily for three months caused mucosal damage in most, but the effect at 10 mg gluten was not statistically significant. The experts noted this was a study with a small number of participants.
    - As data continue to be limited, more robust data on the chronic exposure threshold would be informative, although can be difficult to obtain.
    - **Recommendation:** More research is needed to understand the relationship between gluten exposure and adverse clinical effects in individuals with coeliac disease.

[2] https://www.fao.org/fao-who-codexalimentarius/sh-proxy/ua/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS%2B118-1979%252FCXS_118e_2015.pdf

- While the data for establishing a tolerable daily intake of 10 mg gluten are limited, they remain relevant and the implementation of a definition of gluten-free at levels of gluten no higher than 20 mg/kg has been successful in improving the availability and safety of foods for individuals with coeliac disease.
    - The experts agreed that RfDs for gluten for the PAL framework should not be used as the basis for defining gluten-free labelling.

- Individuals with coeliac disease may react to the ingestion of oats due to either wheat, barley or rye cross-contact (common) or oat avenin sensitivity (rare). Avenin sensitivity is outside the scope of this meeting, and the issue of gluten cross-contact in oats has been addressed in prior FAO/WHO expert consultations[3,4].

Reference dose(s) for gluten and cereals containing gluten

- Establishing a reference dose (RfD) for gluten is important for precautionary labelling of products that do not have a gluten-free label.

- Establishing RfD(s) for gluten in coeliac disease requires a different basis than that used for IgE-mediated food allergies, and must reflect long-term exposure risks.
    - The nature of data relevant for establishing a protective reference dose for individuals with coeliac disease must reflect longer-term exposure risks. This differs from IgE-mediated food allergy, where acute exposures cause reactions. Consequently, the methodology appropriate for risk assessment is different from that for IgE-mediated food allergies. An approach similar to that used for toxicological risk assessment of chronic or cumulative exposure is appropriate and more informative.

- The experts therefore conducted risk assessments to evaluate a RfD for gluten based on chronic gluten exposure, rather than making decisions based on single exposures, as has been done for IgE-mediated food allergy. The goal was to ensure the cumulative daily dose does not exceed 10 mg gluten based on a consideration of daily intake of food from multiple individual eating occasions. The foods within these risk assessment models were assumed to not have a gluten-free label or PAL. This approach ensures the reference dose reflects the broader evidence base and clinical considerations specific to coeliac disease.

[3] FAO and WHO. 2022. *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. Rome. https://doi.org/10.4060/cb9070en

[4] FAO & WHO. 2023. *Risk Assessment of Food Allergens – Part 5: Review and establish threshold levels for specific tree nuts (Brazil nut, macadamia nut or Queensland nut, pine nut), soy, celery, lupin, mustard, buckwheat and oats.* Meeting report. Food Safety and Quality Series, No. 23. Rome. https://doi.org/10.4060/cc8387en

- Modelling reflective of chronic or cumulative daily exposure was conducted for potential gluten RfDs (1 to 10 mg of gluten).
    - The gluten RfD represents the maximum acute gluten dose ingested from a single food per eating occasion.
    - The model was used to investigate the impact of various RfD values on the potential chronic daily intake of gluten.
        - In this model single-eating occasion assumptions were used to derive action levels and the impact of these action levels on chronic exposures was investigated through modelling of daily intakes of multiple food categories, and if these estimated consumption amounts per day would lead to daily doses of gluten exceeding 10 mg.
        - Inputs included potential gluten RfDs (1 to 10 mg of gluten), varying frequencies of unintended presence of gluten in foods, population per day consumption amounts from different countries in a number of food product categories, and various concentrations of unintended presence of gluten, including the maximum allowed concentration not requiring PAL within a risk-based, reference dose-based system.
        - The modelling was attuned to coeliac risk scenarios and chronic exposures.
        - This approach was deemed very conservative.

    - The parameters for modelling (i.e. frequency of cross-contact, concentration of gluten in a product when cross-contact is present, and intake amounts of foods per day) were informed by available peer-reviewed publications and other sources to ensure the model captured real-world situations.
    - The modelling included products with concentrations of gluten greater than 20 mg/kg per eating occasion and no risk communication regarding cereals containing gluten (i.e. concentrations up to the maximum not requiring a PAL statement). The modelling did not indicate realistic exposures to gluten exceeding 10 mg per day. Therefore, this would not lead to an increase in long-term exposure risks from these products.
    - With realistic parameters, gluten RfDs of 5 to 10 mg did not result in median daily gluten exposures exceeding 10 mg.

- These analyses indicated that maximum limits even with acute RfDs above 5 mg gluten could protect individuals with coeliac disease from chronic exposures exceeding 10 mg per day.
    - To avoid different RfDs for the same foods, the experts agreed to recommend a RfD of 4 mg gluten for making risk-based decisions about applying PAL for cereals containing gluten.

- **Recommendation:** A RfD of 4 mg gluten is recommended by the experts for risk assessment of unintended presence of gluten and cereals containing gluten in food products as the basis for deciding whether or not PAL for cereals containing gluten should be applied.

- **Recommendation:** The experts recommend that for guidance on PAL, the previously established RfD of 5 mg total protein for wheat should be replaced with a RfD of 4 mg gluten.

Analytical considerations

- Analytical methods available for gluten quantification, including those endorsed in the Codex Alimentarius Commission document CXS-234[5], must be fit for purpose and validated to reliably measure the 4 mg gluten RfD. These methods cannot distinguish between gluten sources (wheat, rye, or barley), which limits the precision of risk assessment.
- As discussed in prior expert consultations, the development of method performance criteria is needed, as well as more extensive provision of accessible reference materials for gluten[6]. The experts also identified the need for better understanding of assay performance in different food matrices and greater transparency over assay-specific reagents, such as antibodies used in enzyme-linked immunosorbent assays (ELISA), which are critical to assay performance.
    - Measurement uncertainty inherent to current methods requires consideration when interpreting results near the analytical limit of quantification.

Risk assessment and communication for the unintended presence of gluten

- The unintended presence of gluten in foods can occur through cross-contact from the supply chain (including agricultural co-mingling) and during the manufacturing process. To reduce this risk – and analogous to the situation for allergenic foods – food business operators should have controls in place to identify and manage the unintended presence of gluten and cereals containing gluten.

- Applying a risk-based approach to PAL for cereals containing gluten, based on the 4 mg gluten RfD will result in increased food availability for products that currently may not meet the gluten-free requirements but would meet the safety objective for acute and cumulative exposure.

- **Recommendation**: Where gluten-containing cereals are present in the ingredient list (e.g. barley), and the food contains cross-contact above the RfD from other gluten containing cereals (e.g. wheat), competent authorities should consider how the specified cereal name and the optional term "gluten" appear in the ingredient list (e.g. barley (gluten)), separate statement (e.g. "contains: barley (gluten)") and the PAL statement "may contain" (e.g. "may contain: wheat (gluten)"). Failure to do so could lead to confusion for consumers.
    - When a PAL statement results from wheat cross-contact, the specified name "wheat" should be stated explicitly to inform individuals with IgE-mediated wheat allergy.

[5] https://www.fao.org/fao-who-codexalimentarius/sh-proxy/ua/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS%2B234-1999%252FCXS_234e.pdf

[6] FAO and WHO. 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. Rome. https://doi.org/10.4060/cc2946en

- **Recommendation:** Similar to the approaches for food allergens described in previous FAO/WHO expert consultation reports[7,8], gluten and cereals containing gluten should be controlled through appropriate food safety management systems. The manner in which a 4 mg gluten RfD is implemented should align with the same principles for risk assessment as those described in the outputs of previous FAO/WHO expert consultation reports on risk assessment for food allergens.
    - For comparison of an expected exposure expressed in units of total protein from the source to the gluten RfD, a conversion to mg gluten would be required.
    - PAL for cereals containing gluten should only be applied when the RfD for gluten may be exceeded. Additionally, the RfD could be used for risk-assessment and management decisions, including for recalls, compliance purposes and process improvements.
    - The ultimate result of these approaches is that individuals with coeliac disease can have greater confidence that products without a gluten-free claim have undergone risk assessment and provide accurate information on the label.

- The experts noted that some products – where the portion sizes consumed are large (> 200 grams) – could meet criteria for both a gluten-free claim for containing levels of gluten no higher than 20 mg/kg and a PAL for exceeding the 4 mg gluten RfD.
    - This situation causes confusion to consumers who avoid wheat and/or gluten, and might pose a health risk to those with IgE-mediated wheat allergy who assume that consumption is safe because the product is labelled gluten-free.
    - **Recommendation:** the experts recommend that steps be taken to prevent these scenarios from occurring.

Conclusion

- Adopting a 4 mg gluten RfD in a risk-based PAL framework will enhance safety and labelling clarity, reduce unnecessary PAL statements, and expand safe food options for people with coeliac disease and IgE-mediated wheat allergy. This will support better quality of life and consumer confidence.

[7] FAO & WHO. 2023. *Risk assessment of food allergens – Part 3: Review and establish precautionary labelling in foods of the priority allergens, Meeting report.* Food Safety and Quality Series No. 16. Rome. https://doi.org/10.4060/cc6081en

[8] Summary report of the Ad hoc Joint FAO/WHO Expert Consultation on Risk Assessment of Food Allergens – guidance for risk assessment. Summary and Conclusions. https://openknowledge.fao.org/handle/20.500.14283/cd6046en and https://www.who.int/publications/m/item/ad-hoc-joint-fao-who-expert-consultation-on-risk-assessment-of-food-allergens-guidance-for-risk-assessment

Annex 1. List of participants

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