



VKM Protocol 2023

Protocol for mapping of nutrients, food additives and contaminants in plant-based and gluten-free food products

From the Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food, and Cosmetics of the Norwegian Scientific Committee for Food and Environment

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The Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food, and Cosmetics of the Norwegian Scientific Committee for Food and Environment

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Preparation of the opinion

The Norwegian Scientific Committee for Food and Environment (Vitenskapskomiteen for mat og miljø, VKM) appointed a project group to draft the protocol. The project group consisted of VKM members and VKM staff. The Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food and Cosmetics assessed and approved the final opinion (VKM, 2018).

Authors of the opinion

The authors have contributed to the opinion in a way that fulfils the authorship principles of VKM (VKM, 2019). The principles reflect the collaborative nature of the work, and the authors have contributed as members of the project group and/or the VKM Panel on Food Additives, Flavourings, Processing Aids, Materials in Contact with Food and Cosmetics.

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Competence of VKM experts

Persons working for VKM, either as appointed members of the Committee or as external experts, do this by virtue of their scientific expertise, not as representatives for their employers or third-party interests. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

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Glossary

Environmental contaminant includes any chemical that accidentally or deliberately enters the food raw material from the environment.

Food additives are substances intentionally added to food for preservation purposes, to enhance colour or preserve flavour, enhance its texture or appearance, or for other technological functions.

Food processing is the transformation of raw ingredients into food products. Some common food processing methods include thermal processing, mechanical processing, fermentation, preservation, packaging, and extrusion. Each method is chosen based on the desired outcome and characteristics of the food product being processed.

Food processing methods includes all methods used to turn raw materials into food products.

Free-from (“Fri For”) food products are products in which specific components, such as lactose or gluten have been removed. These products are not necessarily plant-based and could include animal-derived components.

“Gluten-free” is a statement that may only be made when the food sold to the final consumer contains no more than 20 mg/kg of gluten (Regulation (EU) No 828/2014 on the requirements for the provision of information to consumers on the absence or reduced presence of gluten in food).

Natural toxins are toxic compounds that are produced by living organisms, such as mycotoxins and plant toxins.

Plant-based products are food items made from plants such as vegetables, fruits, nuts, grains, and legumes, that do not contain any animal and animal-derived ingredients like milk, egg, or meat. Within this broad category certain products are made to mimic meat and dairy products. Terms used to describe such plant-based food products are plant-based substitutes, alternatives, meat free, or plant-based analogues or replacers for products such as dairy products, meat burgers or meat sausages. In this protocol, “plant-based products” are products designed to mimic similar products of animal origin.

Process-induced contaminants are substances that form in food or in food ingredients when they undergo chemical changes during processing such as fermentation, smoking, drying, refining and high-temperature cooking.

Scoping review is a type of knowledge synthesis that follows a systematic approach to map evidence on a topic and identify main concepts, theories, sources, and knowledge gaps (Tricco et al., 2018).

1 Introduction and aim

There is a growing supply of plant-based and "Free-from" ("Fri For" in Norwegian) food products on the market. In recent years the number of vegetarian and vegan products have increased significantly. Today we find plant-based analogue products for meat and milk, new types of snacks, and various types of "Free-from" products including gluten-free products, in our food markets and stores.

The content of nutrients, food additives and contaminants in plant-based and gluten-free products differs from that found in similar dairy and meat products and foods containing gluten (Norwegian Food Safety Authority and Institute of Marine Research, 2022; Pastell et al., 2021). This is primarily due to differences in the following: nutritional and contaminant content of the raw materials, needs for additives, and production methods. Fortification may counteract some of the differences pertaining nutrient content.

1.1 Plant-based analogues to meat and dairy products

The term plant-based products are food items made from edible plant raw material, such as vegetables, fruits, nuts, grains, and legumes, that do not contain animal-derived ingredients such as milk, egg, meat, or fish. Some plant-based food products are designed to specifically mimic animal-based products. These products are described by a plethora of terms: sometimes called plant-based meat or dairy substitutes, alternatives, analogues, replacers, or meat or dairy-free (contains no milk or milk products). Although these plant-based products are designed to mimic similar animal-based products, it is not yet known to what extent consumers actually use them to replace animal-based products. To avoid confusion, in this protocol these products are described with the term "plant-based products".

1.2 Gluten-free products

Free-from products are defined as products that do not include one or a few specific components e.g. lactose or gluten. Free-from products are not necessarily plant-based and can include animal-derived components. Gluten-free products are first and foremost marketed for consumers with celiac disease or intolerance towards the gluten protein. According to the EU Regulation on the requirements for the provision of information to consumers on the absence or reduced presence of gluten in food, the statement "gluten-free" may only be made where the food as sold to the final consumer contains no more than 20 mg/kg of gluten (Regulation (EU) No 828/2014). Additionally, the statement "very low gluten" may only be made where the food, consisting of or containing one or more ingredients made from wheat, rye, barley, oats, or their crossbred varieties which have been specially processed to reduce the gluten content, contains no more than 100 mg/kg of gluten.

1.3 Food processing methods

Food processing is the transformation of raw materials into food products. Food processing methods include all methods used to turn the raw materials into food products. All identified and relevant information on the use of processing and processing methods for the selected food products will be included in this mapping.

1.4 Aim

The aim of this project:

- 1) Identify relevant plant-based and gluten-free products.
- 2) Identify similar food products for meat, dairy, and gluten-containing product categories, based on common use, market shares and, if applicable, dietary surveys.
- 3) Identify new plant-based snack products and similar traditional plant-based snacks relevant for inclusion in the mapping and select products for inclusion.
- 4) Identify nutrients and contaminants for which the main raw materials in the selected food products are known or expected to be an important source.
- 5) Identify all food additives used in the production of the selected products.
- 6) Perform a scoping review to systematically map the research literature on
 - a. Concentration data for nutrient content, food additives, natural toxins, environmental and process-induced contaminants in the selected food products.
 - b. Food processing methods used in the production of the selected food products.

1.5 Delimitations

The following will not be included in this mapping:

- Food allergens
- Microbial hazards

2 Methods

A step-wise approach will be used as shown in Figure 2-1. We will start by identifying and selecting food products to be included in the mapping. Based on the raw materials in these products, nutrients and contaminants will be identified and selected for inclusion. Moreover, all food additives used in the selected products will be included in the mapping. The last step is to perform a scoping review for the selected food products to prepare 1) an overview of concentration data for nutrients, food additives and contaminants, and 2) an overview of the food processing methods. More details on the procedure are given in Sections 2.1, 2.2 and 2.3.

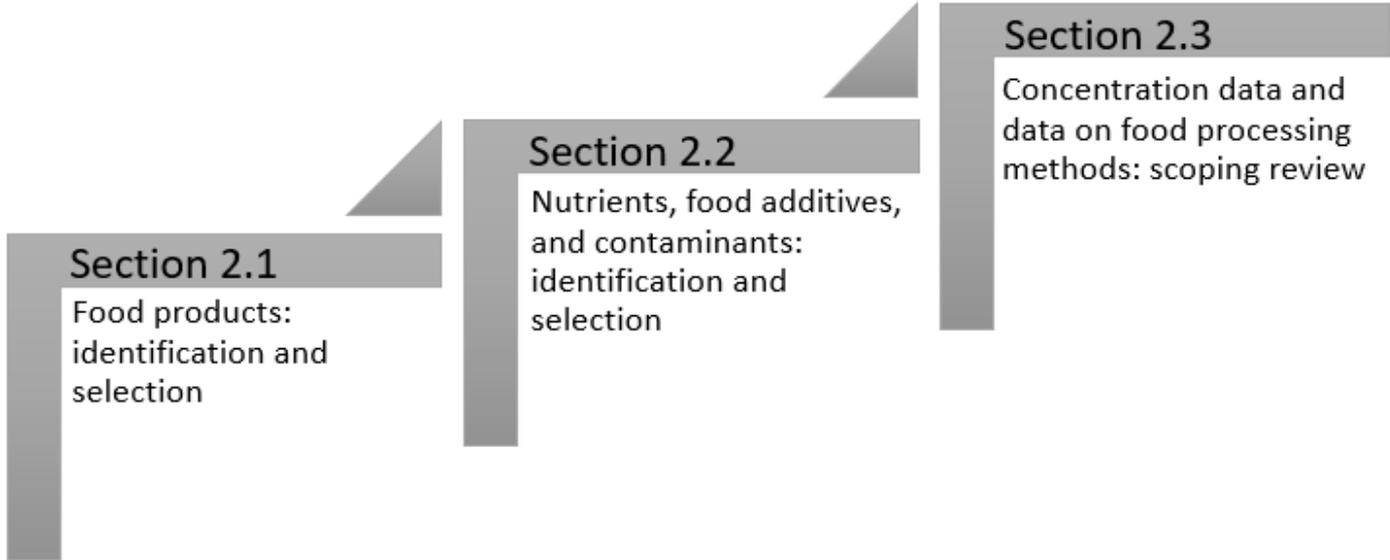


Figure 2-1. An overview of the steps included in this mapping.

2.1 Food products

An overview of the food product categories and the product types included in this mapping is given in Figure 2.1-1.

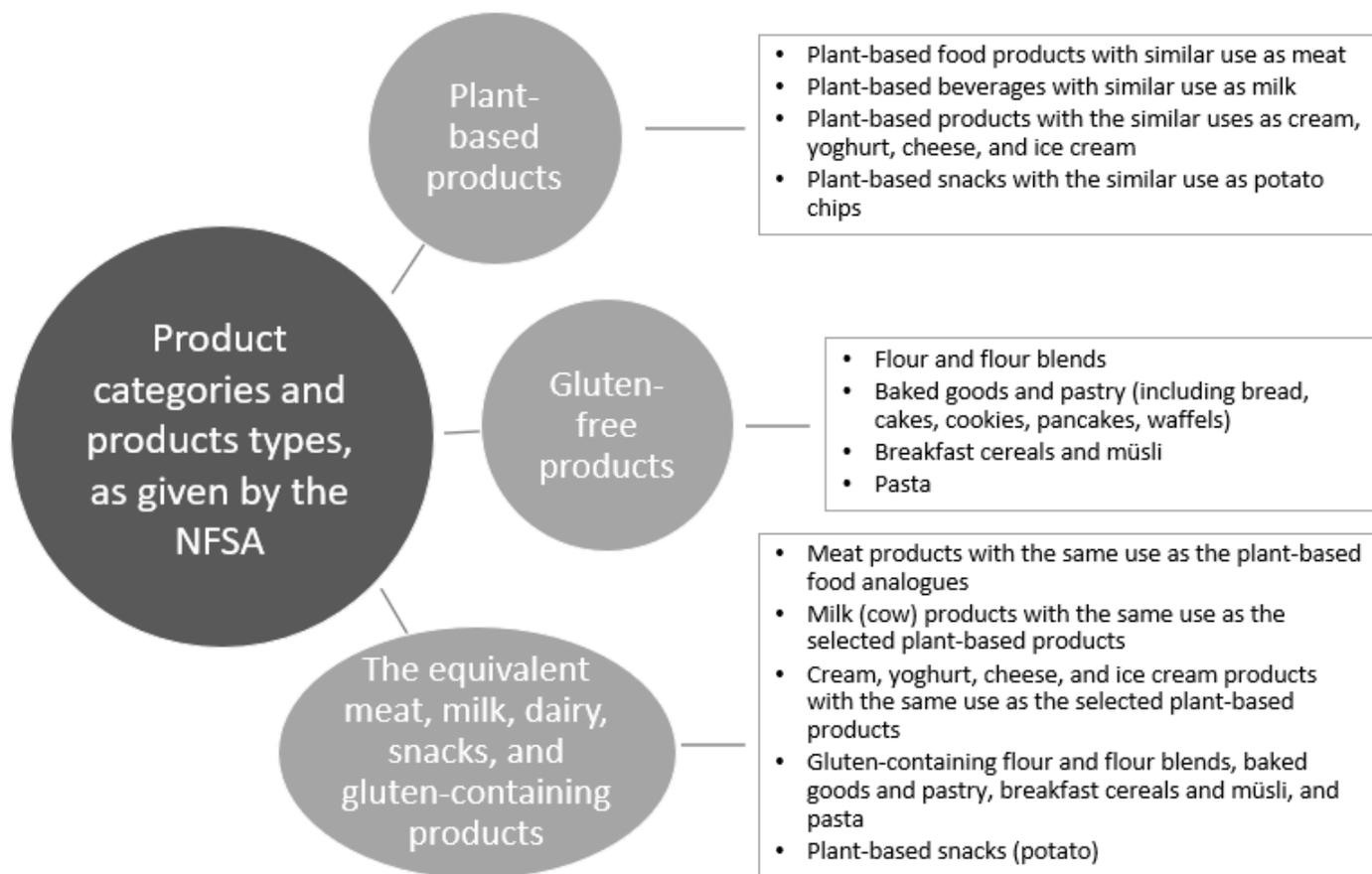


Figure 2.1-1. Food product categories and product types included. NFSA: Norwegian Food Safety Authority.

VKM will use market share and intake data for the selection of food products to be included. We plan to use the following sources for market share and intake data:

1. A report describing sales of plant-based food products and similar products of animal origin in Norway in the period 2016 to 2020 (Grimsby et al., 2021).
2. Webpages of Norwegian grocery stores.
3. Data from food producers and grocery store chains.
4. Intake data from Norkost 3, a national dietary survey (Totland et al., 2012).
5. Intake data from the Norkost 4 pilot study, conducted by the Norwegian Institute of Public Health and the University of Oslo.

The second point will be delimited to the umbrella grocery chains "NorgesGruppen", "Coop" and "REMA 1000", which together provide more than 95% of the market share in Norway (Wifstad et al., 2018). The companies' webpages will be used if available and if it is possible to sort the product list by "most purchased" ("mest kjøpte" in Norwegian). In addition, request for information will be sent directly to the umbrella chains by e-mail (the third point).

The final selection of food product categories will be based on expert judgement. For each food category listed in Figure 2.1-1, the number of selected products will be minimum three.

2.2 Nutrients, food additives and contaminants

All food additives reported used in the selected food products (Section 2.1) will be included in the mapping. The contaminant groups will be limited to natural toxins, environmental contaminants, and process-induced contaminants.

It will not be possible to include all nutrients and all natural toxins, environmental contaminants, and process-induced contaminants in the selected food products in the mapping within the given time frame. Therefore, a selection will be performed according to certain criteria, and an overview of the criteria that will be applied is shown in Figure 2.2-1.



Figure 2.2-1. Criteria for selection of nutrients and contaminants.

Nutrients included in the mapping will be selected based on dietary sources analyses. Energy and energy providing nutrients will be included. Relevant vitamins and minerals that the similar animal-based products are shown to be important sources for will be included. Also, nutrient profile of the plant-based products will be evaluated and based on this profile, more nutrients may be included in the mapping.

The VKM knowledge base will be used to identify and select contaminants of which the food item or its raw materials are known or expected to be important contributors to the total exposure from food (see Section 2.1). The base contains more than 40 different contaminants and data on food items consumed by the Norwegian population that are known or expected contributors to exposure for each of the contaminants.

The final selection of nutrients and contaminants to be included will be based on expert judgement.

2.3 Concentration data and data on food processing methods

2.3.1 Scoping review

A scoping review will be performed to identify 1) concentration data for nutrients, food additives, and contaminants, and 2) data on processing methods used to prepare the selected food products. A scoping review is a type of knowledge summary that aims to map and describe the existing research literature on a particular theme. We will follow the "Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist" (Tricco et al., 2018).

Traditionally, a scoping review includes systematic searches of the literature, including grey literature. As traditional databases such as Medline and Embase may not be main sources for information on concentration data and food processing methods, we will initially seek it from other sources (Figure 2.3.1.1-1). Concentration data will be retrieved from web pages of relevant institutions (national and international) and by contacting industry asking for data. Regarding information about food processing methods, we will primarily use textbooks on food technology and food processing. Literature searches will only be done to identify concentration data if considered necessary. The data sources that will be used are described in Sections 2.3.1.1 and 2.3.1.2.

2.3.1.1 A detailed description of the collection of relevant information will be provided in the report. Identification of concentration data

The identification of concentration data will follow an iterative approach. An overview of the process is given in Figure 2.3.1.1-1. First, we will attempt to identify concentration data from databases, reports, and the industry fulfilling the eligibility criteria (Table 2.3.1.1-1).

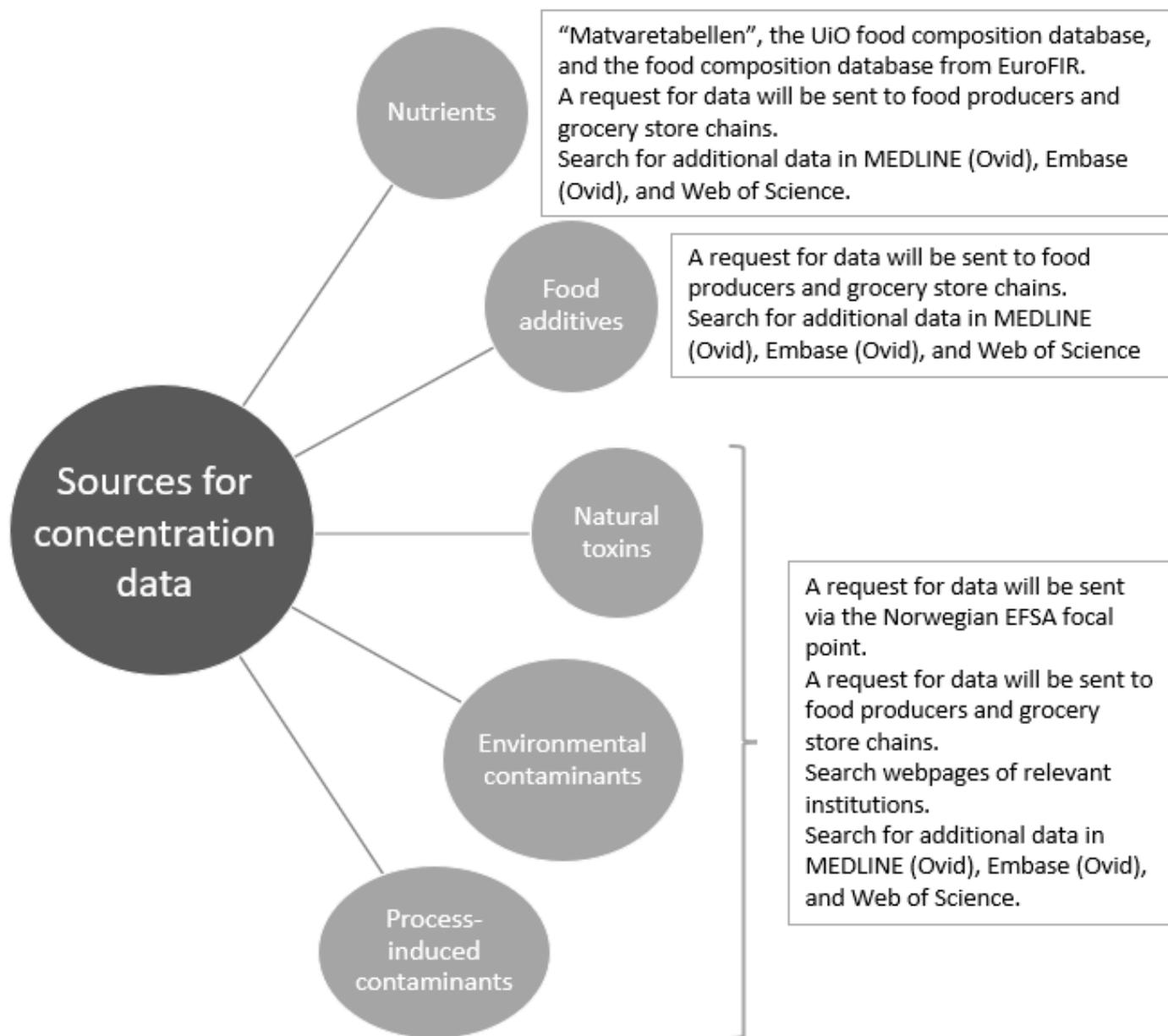


Figure 2.3.1.1-1. Sources for concentration data.

Table 2.3.1.1-1. Eligibility criteria for data from databases, reports, and the industry.

Findings	Concentration data for selected nutrients, food additives, natural toxins, environmental and process-induced contaminants in selected food items.
Data sources	Databases, reports, textbooks, scientific publications
Publication year	From year 2000 until today
Country (sampling)	European countries
Language	Danish, English, Norwegian and Swedish

If additional concentration data are considered needed, a literature search will be performed for one or more of the following: nutrients, food additives, natural toxins, environmental contaminants, and/or process-induced contaminants.

Literature searches

Literature searches will be performed in the databases MEDLINE (Ovid), Embase (Ovid), and Web of Science. The search strategy will be generated in collaboration with a research librarian who will perform the search. Authors will independently, in pairs of two, check 1) titles and abstracts for relevance, and 2) full text articles against eligibility criteria (Table 2.3.1.1-2). Disagreements will be resolved by consensus or by consulting a third author.

The RAYYAN software (Ouzzani et al., 2016) will be used for the screening of titles and abstracts.

Table 2.3.1.1-2. Eligibility criteria.

Outcomes	Concentration data for selected nutrients, food additives, natural toxins, environmental and process-induced contaminants in selected food items.
Study design	Reviews including a systematic literature search
Publication year	From year 2000 until today
Country (sampling)	European countries
Language	Danish, English, Norwegian and Swedish

2.3.1.2 Identification of data on food processing methods

To collect data on food processing methods fulfilling the eligibility criteria (Table 2.3.1.2-1), VKM will search databases, reports, textbooks, scientific publications and contact the food industry. In addition, expert judgement will be used to identify food processing methods.

Table 2.3.1.2-1. Eligibility criteria for data on processing methods

Findings	Data on processing methods used in the production of the selected food products
Data sources	Databases, reports, textbooks, scientific publications
Publication year	From year 2000 until today
Country (sampling)	European countries
Language	Danish, English, Norwegian and Swedish

2.3.2 Data charting

All authors will first extract data from a sample of the sources to ensure that the data extraction is consistently applied. Discrepancies will be resolved through discussions. If necessary, the list for which data items that should be extracted will be modified.

Following the calibration, one author will extract the data and a second author will independently check the data extraction for accuracy and completeness. In case of disagreement, the two authors will discuss to reach consensus. If the disagreement persists, the Panel will reach a final decision.

For concentration data, we plan to extract the following data:

- authors
- title
- type of data source (database/ report/ industry/ publication)
- journal (for publications)
- country
- year of publication
- funding
- reported conflict of interest
- the food products included for analysis
- name of the nutrients, food additives, natural toxins, environmental and/or process-induced contaminants analysed
- relevant concentration data
- analytical method

For data on processing methods, we plan to extract the following data:

- authors
- title
- type of data source
- textbook or journal (for publications)
- country
- year of publication
- funding
- reported conflict of interest
- the food product(s)
- the food processing method(s) described

2.4 Synthesis of results

We will summarize the charted data in figures and tables to provide information on the total body of data. The concentration data with open access will be published as supplementary materials.

In the mapping report we will present overviews of:

- selected food products
- main raw materials in the selected food products
- nutrients and contaminants for which the main raw materials in the selected food products are known or expected to be an important source
- nutrient content in the selected food products
- food additives used, including the amount, in the selected food products
- content of natural toxins, environmental and process-induced contaminants in the selected food products
- comparisons of the concentration data for gluten-free and similar gluten-containing products, the plant-based and similar products of animal origin, and the new plant-based snacks and similar traditional plant-based snacks
- processing methods used in the production of the selected foods themselves or their ingredients
- comparisons of the food processing methods used for production of gluten-free and similar gluten-containing products, plant-based and similar products of animal origin, and new plant-based snacks and similar traditional plant-based snacks

2.5 Data availability

Following FAIR (findable, accessible, interoperable, and reusable) principles for scientific data management and stewardship (Wilkinson et al., 2016) and taking into account licensing requirements related to (re)use and retrieval of data used/created in the present work, original and process data and related supporting information (including, e.g. supplementary files and tables) will be made available on public repositories as described in Pineda-Pampliega et al. (2022).

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