Food composition data: Standardisation & harmonisation for re-use

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Delivering high quality, validated national food composition data & supporting information …

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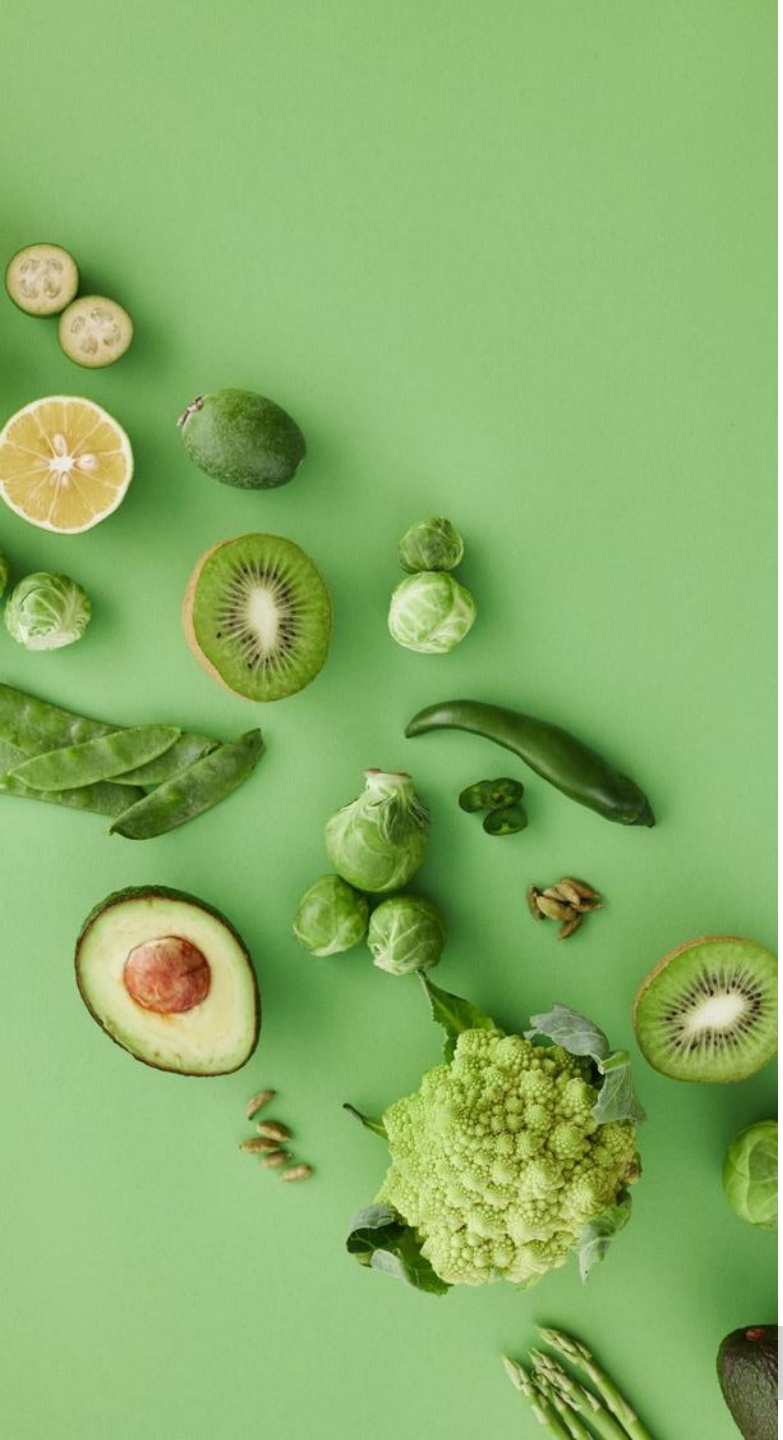


EuroFIR
European Food Information Resource

WHO ARE WE?

- EuroFIR AISBL is an international, member-based, non-profit association established under Belgian law in 2009 by EuroFIR NoE and NEXUS FP6
- **Mission:** Ensure sustained advocacy for food data and related information in Europe and promote standardisation and harmonisation in Europe and beyond.
- **Purpose:** Development, publication, and exploitation of food composition data but also focus on improving data quality …
- Collaborate with 40 compiler organisations worldwide, including Europe, USA, Canada, Australia, New Zealand, Africa, etc.
- FoodEXplorer, platform consolidating global FCD

www.eurofir.or

Power of FCDB

- Used by nutritionists and dietitians, researchers, and policymakers to assess and plan diets, conduct nutritional epidemiology studies, and develop nutritional guidelines and public health policies.
- Helps the food industry in product development (reformulation), labelling, and quality control
- Provide valuable information for consumers to make informed dietary choices

- FCDBs are essential for advancing understanding of food and nutrition, supporting public health, and promoting healthier eating habits …

Examples of Food Composition Databases:

- USDA National Nutrient Database
- 27 EU Food Composition Databases
- FSANZ Nutrient Tables
- Canadian Nutrient File CNF

Food composition data

Provide information about the nutrient content of foods, incl. macronutrients (proteins, fats, carbohydrates), micronutrients (vitamins, minerals), and other food components (e.g., fibre)

Amounts per 100 g or per specific food unit, as consumed

Range of raw and cooked foods and beverages

Country-specific recipes

Data are (increasingly) collected and analysed using standardised methods

(Some) quality control measures in place to validate data

(Irregular) Updates to reflect changes in food composition due to agricultural practices, food processing, etc.

Where does the data come from?

Laboratory analyses, calculated, scientific literature, and other credible sources

Governmental Agencies

United States Department of Agriculture (USDA; Food Central), Public Health England (PHE), Food Standards Australia New Zealand (FSANZ)

Research Institutions and Universities

Various national research institutes, universities, NGOs

Health Canada collaborates with research institutions to compile the Canadian Nutrient File (CNF)

International Organisations

Food and Agriculture Organization (FAO)

International Network of Food Data Systems (INFOODS)

Industry and private sector

USDA Global Branded Food Products Database - public-private partnership

Collaborative Projects

EuroFIR, non-profit Member-based Association, based in Belgium since 2009

FCDB standardisation: Limitations

Different foods consumed (and selected) nationally

Changing nutrient compositions, i.e., growing conditions, varieties, agricultural practices, processing and preparation

Generic foods and recipes, lack of ethnic and traditional foods

Few branded foods, which change frequently

Limited resources (personnel and funding)

Age and sources: old data, borrowed values, missing data

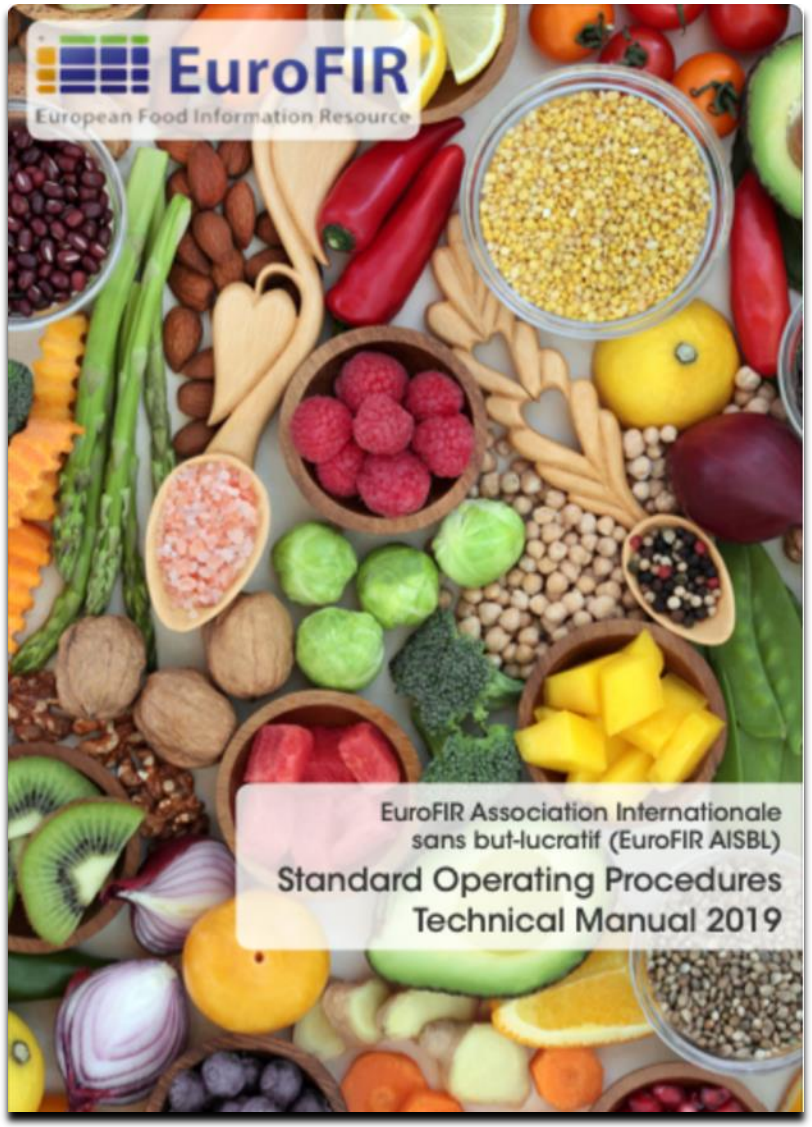
Lack data for specialised foods, e.g., infant and elderly, fortified foods, PGI, PDO, nutrition and health claims, supplements

And every compiler does it differently …

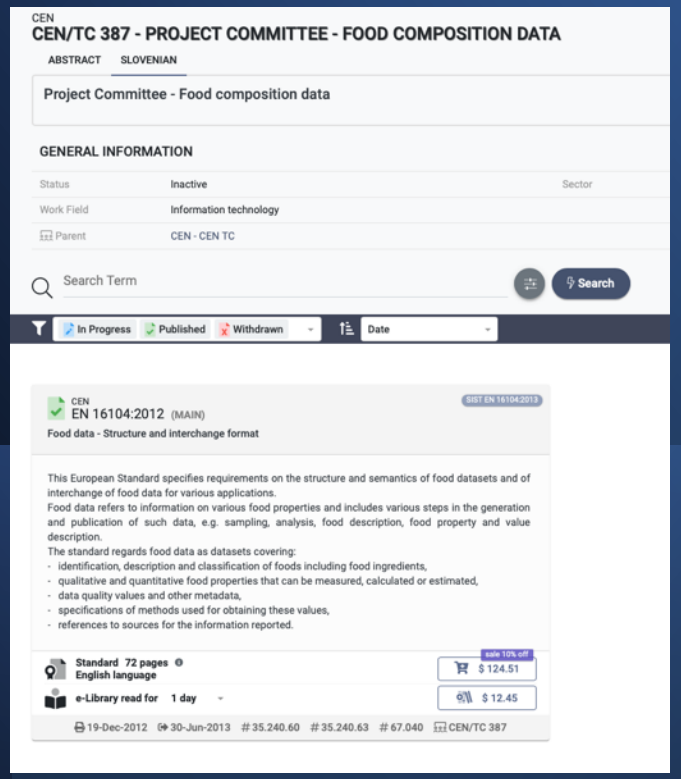
FCDB standardisation

- Planning and defining objectives, e.g., dietary assessment, labelling
- Scope definition, i.e., types of foods, nutrients, and other components to be included based on use
- Data collection, i.e., selection, sampling, analysis
- Data evaluation and compilation, data entry, QC
- Data aggregation, data from different samples of the same food to produce representative values
- Retention factors ↑↑↓↓ (components); yield factors ↑↑↓↓ (weight)
- Data documentation
- Data integration and database management
- Data dissemination

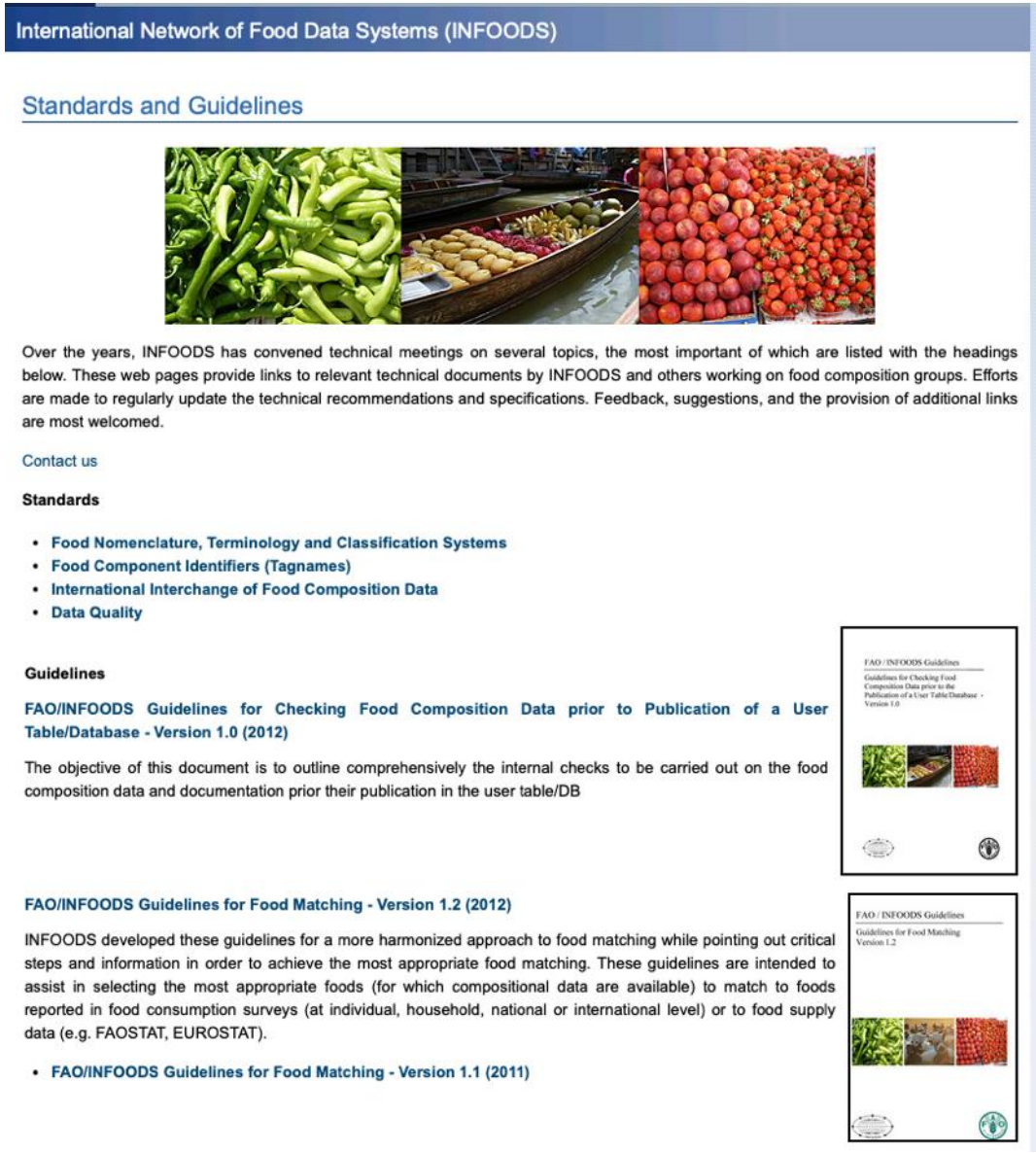
These ensure systematic and reliable compilation of food composition data, making it … good enough for its intended purpose(s)



Zenodo. https://doi.org/10.5281/zenodo.8155094

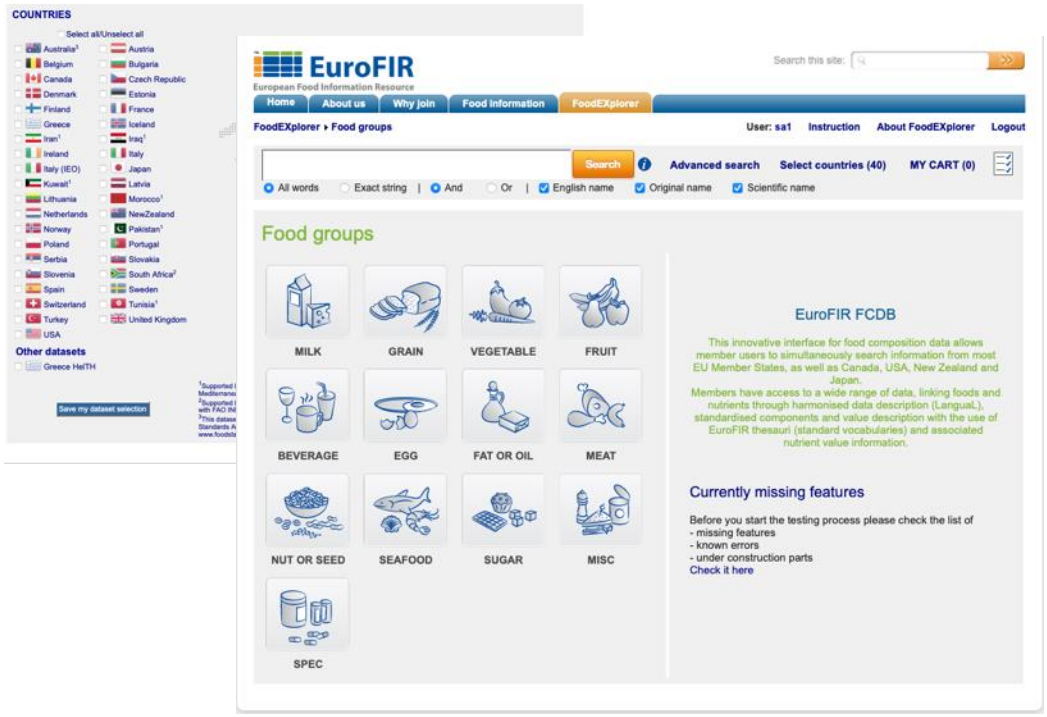


Global standardisation



https://www.fao.org/infoods/infoods/standards-guidelines/en/

FCDB harmonisation: EuroFIR FoodEXplorer



Food composition datasets have inconsistencies …

Documentation of information concerning foods, components, values and references is essential

Foods, components and values need to defined

Data elements and relationships need to be mapped to a common structure using Thesauri

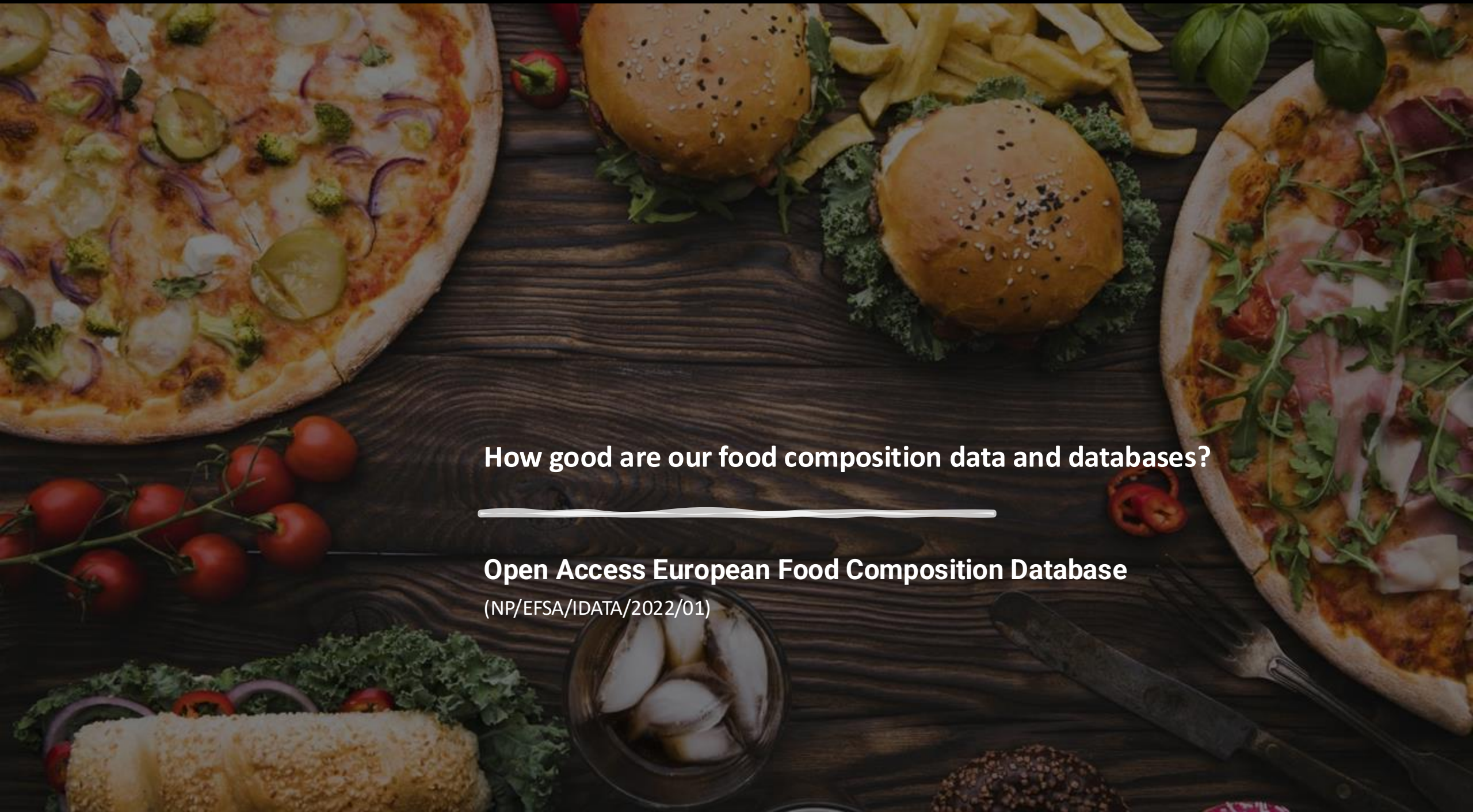
Encoding data in a format readable by both humans and machines to facilitate exchange

EuroFIR Thesauri

- Standardised **controlled vocabularies** are essential
- EuroFIR specifications are based on a relational database model with four main entities:

  Food, Component, Value, Reference
- Entities are mandatory for documentation.

Thesaurus name	Description	Version	Published	Entity
Acquisition Type thesaurus	Description of the origin of the data reported (host system, scientific literature, analytical results, etc.)	1.2	2017-05-25	Value Reference
Component thesaurus	Descriptors (identifiers) that are used to identify the component or physico-chemical property to which the reported value relates. It is organised into a hierarchy.	1.6	2022-05-24	Component
Matrix Unit thesaurus	Terms for the amount of the matrix material that has quantity reported as the value, usually expressed using the preposition per.	1.5	2019-10-04	Value
Method Indicator thesaurus	Terms for documenting the method used to obtain a compositional value, including analysis, calculation and imputation. The terms are organised in a hierarchy.	1.6	2022-05-24	Value
Method Type thesaurus	A general indication of the type of method used to obtain the associated value.	1.2	2017-05-25	Value
Reference Type thesaurus	Details of bibliographical references describing documents that are sources of data for value, method, recipe, etc.	1.1	2011-09-08	Reference
Unit thesaurus	Terms for the measure used for the amount of the component value or measurable property reported as the value including terms for dimensionless numbers for values that are expressed as ration or as a percentage.	1.3	2022-05-24	Value
Value Type thesaurus	Description of the data values or a qualitative description of the value when no value can be given.	1.4	2022-05-24	Value
Food Classification Thesaurus	A system for classification of foods developed in EuroFIR for harmonized classification in food composition databases.	LanguaLTM 2014-1.0	2016-04-08	Food



How good are our food composition data and databases?

Open Access European Food Composition Database

(NP/EFSA/IDATA/2022/01)

Overview of project tasks – 1st phase

- **D1.1** Develop a **search protocol** & carry out an **extensive literature search** on methodologies for quality evaluation, collection, storage and maintenance of national/international FCDBs
  - What criteria permit quality evaluation of food composition data collection and storage, and database creation and maintenance → 570 articles and 26 grey literature documents
  - What factors (edible parts, retention, yield factors, etc.) affect quality of food composition data collection and storage, and database creation and maintenance (Task 1.5) → 128 articles and 53 grey literature documents

- **D1.2** Deliver a report on the **methodology for evaluation of food composition data** from national FCDBs (incl. fortified foods and food supplements) based on literature review
  - EuroFIR quality management framework (built on previous work globally)
  - FAO/INFOODS evaluation framework adapted for European FCDBs

Quality criteria for values and databases

- Databases

Food coverage

Food description

Component coverage

Component identification

Units and matrix units

Data sources (food or value level)

Documentation

Validity of values (i.e., as consumed)

- Values

Acquisition type (origin)

Reference type

Method type (analytical, calculated)

Value type (mean, trace, logical zero)

Method indicator (HPLC, energy formula, recipe calculation)

Age & Source

Westenbrink et al., (2021) https://doi.org/10.1016/j.jfca.2021.103968; Charrondiere et al., 2023 https://doi.org/10.4060/cc5371en

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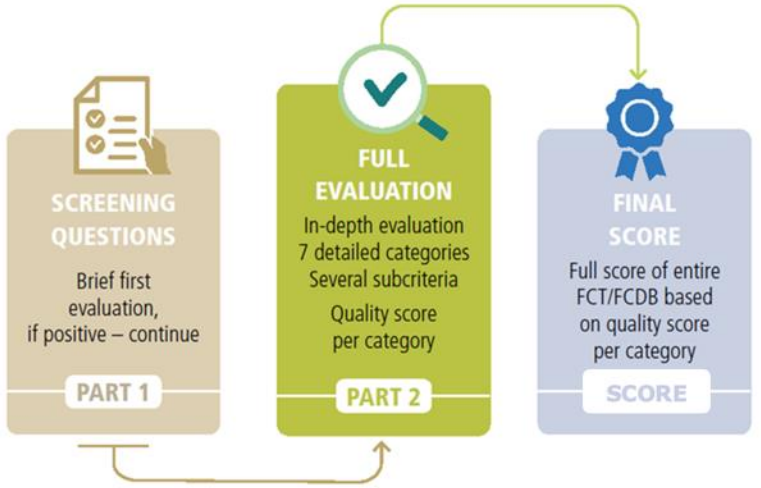
Overview of project tasks – 1st phase

- **D1.3** Deliver a report **describing the quality** of the latest published versions of at least **16 national FCDBs** (EU, EFTA and IPA countries) – assessed using criteria identified for values and databases

  - Overall quality of **databases** was above average
  - Highlighted missing documentation and possible errors
    → help compilers to review and improve documentation
  - Strengths and weaknesses in evaluation were identified and recommendations for improvements proposed
  - Evaluation could be automated or semi-automated



  - More than 80% of all **values** are high quality or above average
  - Reasons for the lower quality values were identified
  - Food coverage approaches strengths and weaknesses identified
  - Automation likely to produce variable results and additional manual input required
  - Algorithm-based approach for estimating missing values would need development and testing

EFSA Project team

- **Integrated Data | IDATA**
  - **Team Data Gateway & Outreach**
    Anastasia Livaniou
    Sofia Ioannidou
  - **EFSA Tasking Grant collaborators**
    Androniki Naska
    Elissavet Maria Valanou
- **Nutrition and Food Innovation | NIF**
  - **Team Human Nutrition**
    Lucia Fabiani
- **Methodology and Scientific Support | MESE**
  - **Team E2E Evidence**
    Davide Arcella
    Irene Munoz
  - **Team Analysis**
    Rita Sofia Ferreira de Sousa
    Zsuzsanna Horvath
- **Finance Services | FIN**
  Lisa Anna Brovall
  Laura Perati

Project Consortium

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CAPNUTRA CAPACITY DEVELOPMENT IN NUTRITION

UDRUŽENJE ZA ISTRAŽIVANJA U ISHRANI

- **Premotec GmbH** (PMT; CH)
- **Institute of Agricultural Economics and Information** (UZEI/IEAI; CZ)
- **National Institute of Health DR Ricardo Jorge** (INSA; PT)
- **National Institute for Public Health and the Environment** (RIVM; NL)
- **Finnish Institute for Health and Welfare** (THL; FI)
- **L'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail** (ANSES; FR)
- **MATIS** (IS)
- **Agricultural University Athens** (AUA; GR)
- **University of Granada** (BEDCA; ES)
- **Research Centre for Food and Nutrition** (CREA; IT)
- **National Food Institute, Technical University of Denmark** (DTU; DK)
- **Swedish Food Agency** (SFA; SW)
- **University of Vienna** (UVI; AT)
- **Food Research Institute National Agricultural and Food Centre** (NPPC; SK)

Conclusions

Standardisation and harmonisation are separate issues with standardisation enabling harmonisation …

Controlled vocabularies enhance data accuracy and usability (interoperability)

Standardisation and harmonisation FCD are critical to understanding diet-health relationships and sustainability

Public health policies, product development or reformulation, information …

Ongoing challenges in FCD standardisation and harmonisation incl. documentation, sampling, and data quality

Organisations such as FAO INFOODS, EuroFIR, and EFSA have role in these activities

Increased automation has potential but requires further development and **testing**

Enhanced use of FCD in digital health applications and AI-driven platforms can further extend its relevance but also vulnerabilities

Thank you!

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