The Compositional Dietary Nutrition Ontology (CDNO): from PGR to production and consumption

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Food Composition Tables and Databases (FCDBs) – Widely used information sources

Low granularity
- No within-species variation
- Not cultivar-specific

Lack functional information
- Key micronutrients often under-reported
- No functional information

Azman Halimi et al., 2020
doi.org/10.1002/jsfa.10157
The food production - dietary nutrition landscape

Agriculture

Nutritional information flow

Common vocabulary between domains

Ontology: A set of concepts within a domain

Classes and relationships

Health
Domain-relevant knowledge representation and ontology class/term re-use

Ontologies in the Biological and biomedical domain

OBO Foundry

Provide a set of principles for ontology development

OBO ontologies in the Food/Nutritional domain

OBI – Ontology for Biological Investigations
ONS – Ontology for Nutritional Studies
FOBI – Food Biomarker Ontology
ONE – Ontology for Nutritional Epidemiology
ChEBI – Chemical Entities for Biological Interest
FoodOn – Food Ontology

CDNO – Compositional Dietary Nutrition Ontology

Chemical Entities for Biological Interest (ChEBI)

Relevant information for dieters or breeders

Exhaustive level of granularity

(Andrés-Hernández et al. 2020)

Andrés-Hernández et al., 2020
https://doi.org/10.1002/csc2.20092
Scope of component/concentration classes

‘Dietary nutritional component’ - structured terms according to domain-relevant categories for chemical food composition.

- Focuses on components typically quantified in an analytical chemistry laboratory
- Facilitates description, communication and exchange of nutritional composition datasets between domains
- Reuses terms from ChEBI where available

‘Nutritional component concentration’ terms to represent quantification of components in the ‘dietary nutritional component’ class.

- Used to annotate datasets that quantify concentration of chemical nutritional components
- Use with terms from FoodOn ‘Food product by organism’ [reused terms from Plant Ontology and NCBI Taxon ID]

Structured terminologies to describe nutritional attributes of material entities that contribute to human diet.

https://cdno.info/
Major classes of ontology terms in CDNO
Dietary nutritional component
519 terms

- 10 upper level classes
- 485 assigned to CHEBI and ENVO
- 21 added in CHEBI
- 13 formally described in CDNO

Nutritional component concentration
519 terms

Term information
- database cross reference
  - INFOODs: GLUS
  - INFOODs: GLUFB
  - USDA_NDB: 1011

Reused ontology terms
Concentration of glucose in material entity
Issues in classification, discussed and resolved by domain experts

Ongoing philosophical discussions...

vitamins
roles or material entities?

Vitamin C Ascorbic acid

https://github.com/Southern-Cross-Plant-Science/cdno
Online GUI and use-cases under development - multiple data sources

Nutritional Component

- carbohydrate
- ash
- dietary fibre
- disaccharide
- monosaccharide
- oligosaccharide
- polysaccharide
- dry plant matter
- lipid
- mineral nutrient
- plant secondary metabolite
- protein
- salt
- vitamin
- water

Food / crop source

- Food group: Crop plant
- Crop: bamba groundnut
- Crop part: seed

Data source

- CropStoreDB
- GeoNutritional
- Food Composition

www.cdno.info
Nutritional information flow

Andrés-Hernández et al., 2020
https://doi.org/10.1002/csc2.20092

Andrés-Hernández et al., 2022 in preparation
https://doi.org/10.1002/csc2.20092