# Food Nutrition Security Cloud

## Deliverable 4.5

## Mapping tools for existing food intake and consumer behaviour data

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# 1. Publishable Summary

There is a need to improve the infrastructure which supports the reuse of data in the food nutrition and security domain. Dietary intake and consumer behaviour data are widely used to provide information on dietary and meal patterns, food contaminants and residues, the association of dietary intake with health outcomes, and inform determinants of food choice. Existing datasets within these areas are particularly fragmented which limits their reuse thus to overcome these issues and support data reuse there is a need for tools to facilitate the process of aligning or mapping food intake and consumer behaviour data. Development of specific tools in this area are needed due to the complex and diverse nature of both data collection and nomenclature (coding) used.

This deliverable reports on the activities undertaken within task 4.4.1 to advance mapping strategies for food intake data and the relevant learnings from these. Given the variance in levels at which dietary intake data can be collected, the mapping activities for these data took 2 separate approaches: 1) mapping at a food level for data collected using 24-hour recalls or diet diaries 2) mapping across food groups for data collected using food frequency questionnaires (FFQs).

Within the first approach, different food items and recipes from existing datasets, which were not harmonized or coded using FoodEx2, were matched to corresponding FoodEx2 terms and facets. For this task, two methods were applied. The first approach used StandFood to perform matching of uncoded foods, based on the English food names/descriptions. Using a test dataset, it returned an accuracy level of >70% for individual food items, and 32% for recipes. The second approach used a ML-based multi-class classification method to perform mapping based on food nutrient profiles. This method achieved 55% accuracy for individual food items. Whilst good results using these methods were achieved, challenges remain including the impact of human error from manual coding on ML approaches, the variance in names for similar foods across countries and languages, completeness of data within datasets and the lack of standardized formatting across datasets.

Within our second approach to dietary intake data, (data coded at a food group level) a visualization map of previously used FFQs was created. Mapping guidelines were developed



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across food groups, food items and frequency of response categories. The feasibility of this mapping system was then tested through a comparison exercise between two FFQs; Food4Me and NHANES. Good similarity was observed between mean food group intakes for some food groups whilst differences were identified across others. The main reasons for these differences arose from: variation between frequency of consumption response categories between FFQs, variations between food items listed within specific food groups across FFQs, presence of non-comparable food items which were listed in 1 FFQ but not captured within the other.

The tools and approaches described within this deliverable will be further used and tested within the WP5 demonstrator analyses. This deliverable advances the mapping strategies for food intake data for future use.



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# 2. Introduction

There is a need to improve the infrastructure which supports the reuse of data in the food nutrition and security domain(1). The Food Nutrition and Security Cloud (FNS-Cloud) consortium was established with the overarching aim to overcome existing fragmentation issues within FNS data by integrating existing data and developing an infrastructure and services to exploit food, nutrition and security data (data, knowledge, tools – resources) for a range of purposes (2).

The FAIR principles, act as overarching guidelines for data holders/researchers to put data in a position to be reused (1). Applying the FAIR principles to research data will be mutually beneficial to both scientific research and society. Recognising this, the European Commission (EC) has established an expert group which aims to turn the concept of FAIR data into reality in order to open up science and research (3), and through EOSC, to federate existing research data infrastructures in Europe and realise a web of FAIR data and related services for science, making research data interoperable and machine actionable (4).

Supporting data reuse in the area of FNS is a key aim of FNS-Cloud. It is recommended that instead of collecting new data, datasets already in existence could be reused or used in combination with other datasets to answer ongoing or future research questions. This is further described in FNS-Cloud deliverable 3.1. Dietary intake and consumer behaviour data are widely used to provide information on dietary and meal patterns, food contaminants and residues, the association of dietary intake with health outcomes, and inform determinants of food choice. Existing datasets within these areas are particularly fragmented which limits their reuse. Therefore, to overcome these issues and support data reuse there is a need for tools to facilitate the process of aligning or mapping food intake and consumer behaviour data. Development of specific tools in this area are particularly needed due to the complex and diverse nature of both data collection and nomenclature (coding) used.

## 2.1 Dietary intake data

Dietary intake data are used to determine food, nutrient and ingredient intakes at both individual and population levels (5). Dietary data can be assessed in clinical settings to support personalised



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care, or within population groups for research purposes and to develop government policy and public awareness campaigns [(6)]. The level of detail collected when assessing dietary intake is dependent on the method of collection chosen. The main methods of collection include food diaries, 24-hour recalls, diet histories and food frequency questionnaires (FFQs). Food diaries, 24-hour recalls, and diet histories collect intake data at an individual food level with detailed assessment of portion size. Food diaries and 24-hour recalls collect information on actual food eaten on a specific day(s) and use this information to estimate usual daily intake. FFQs collect intake data at a food or food group level over a longer period of time providing a crude estimate of usual daily intakes.

The complexity in the mapping and aligning of dietary intake data comes from the variety of methods available to collect the data in addition to the numerous sources of portion size data.

Once dietary intake data has been collected, it is linked to a composition dataset which generates a complete dataset containing detailed information on individual foods and their corresponding food groups, portion size (depending on the dietary intake collection method used), and nutrient composition. Harmonisation across dietary composition databases has greatly improved in recent years through use of standardised food description systems [(7)], and will not be the focus of this report, as this is covered elsewhere.

## 2.2 Mapping across dietary intake datasets

Harmonisation across datasets is aided by following standardised guidelines and practices during data collection [(8)]. In order for food data to be easily reused, whilst ensuring the quality of the data is maintained, the description of food items (along with portion size) needs to be accurate, detailed and consistent. Foods should be described as clearly and accurately as possible to ensure the maximum amount of foods can be matched appropriately and the resulting analysis accurate [(9)]. If food items aren't well defined even data of otherwise good quality can be compromised [(10; 11)]. As dietary intake data can be collected, and then coded at different levels (e.g., individual foods, food groups, and food categories), the mapping of datasets collected using different methods needs to be considered carefully. For example, reported consumption of foods at an individual level, can be subsequently aggregated to food groups, and mapped to data from



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existing food groups, if the relevant information for categorisation into food groups is provided. Unless this hierarchical approach is transparent, combining different datasets together will be challenging.

Furthermore, FFQs are frequently designed to capture information on specific types of foods or foods that are not consumed widely within a certain population (e.g., to quantify consumption of seafood) so may not contain a comprehensive list of foods. On the other hand, 24hr recalls and food diaries aim to collect information on all foods and beverages consumed. In addition, differing methods collect data across different timeframes. 24hr recalls, collect information on a preceding day, and when several of these are collected over a given period (e.g., 2 or 3 within 1-2 weeks) one can estimate habitual intake. Whereas FFQs collect data from the preceding month, 6 months or year, assess habitual intake, but over a completely different timeframe. These subtle but important differences mean that the mapping and merging of dietary intake data cannot be a standardised function, and there will be a need for subject matter expert interpretation of both the data and the research question, to determine if the data are appropriate to be merged and which method to use.

The following document outlines the development of these tools in FNS-Cloud.

## 2.3 Consumer behaviour data

Consumer behaviour research addresses the understanding of human behaviour relating to the purchase and consumption of economic goods [(12)]. Research in this area strives to understand associated consumer choices and related cognitive and emotional processes. Within the realm of food and nutrition, the study of consumer behaviour is centred on food choice, motives for food purchasing, and perceptions of risk in relation to certain foods and new food technologies. Knowledge of consumer behaviour, and the factors influencing the same, can inform food product development, dietary health public policy and marketing strategies [(13)].

The majority of methods to collect consumer behaviour data use qualitative approaches, therefore in most cases it is not possible to automatically map across these data. When conducting unstructured interviews or focus groups, researchers typically develop their own topic



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guide for use based on their individual research hypothesis. Furthermore, the included population is usually not representative and factors such as the dynamics between the participants and the level of training/experience of the researcher can influence the data arising from the study. The data gathered tends to inform the themes/results derived therefore comparisons are possible in some cases, but this is not consistent.

Conversely, data on the factors influencing food choice is typically collected using questionnaires (13) which are quantitative in nature; hence, the resulting data is often comparable between different population groups (even across various countries). Whilst the data arising from questionnaires is quantitative, the development of questionnaires arises from qualitative research, therefore consideration should be given to the facets included in questionnaires, the population studied, and whether the tool has been validated (13) before mapping and merging across different questionnaires.

Consumer behaviour and dietary intake are highly linked fields with a great deal of interaction between factors affecting both. Within the DEDI-PAC project, a framework was developed which visualises the Determinants of Nutrition and Eating (DONE Framework) across different population groups (14). This framework is freely accessible (*http://uni-konstanz.de/DONE*) and is expected to evolve over time as experts add further determinants and ratings.

In 2021, the Communities on Food Consumer Science (COMFOCUS) project was launched (*https://fnhri.eu/projects/comfocus/*). COMFOCUS aims to reduce data fragmentation across food consumer science and to develop a library of meta data and digital service tools to form a knowledge platform within this area. Partners from within the FNS-Cloud consortium are also involved in this initiative. As the project develops further, FNS-Cloud will align with these experts' recommendations on how to harmonise research approaches and methodologies. The mapping of consumer behaviour data will not form the basis of this deliverable.

## 2.4 Deliverable aims and objectives

As previously mentioned, there is a need for tools/services to facilitate the efficient process of mapping and aligning datasets associated with food intake and consumer behaviour.



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The focus of this report is not on the statistical approaches which will be outlined in more detail in WP5, but the tools used to support the initial mapping and then combining of food intake data for subsequent analysis. Therefore, this deliverable will summarise approaches/tools used in the merging of data from different sources and report on the mapping activities undertaken and the relevant learnings from these.

Given the variance in levels at which dietary intake data can be collected, the mapping activities for these data will take 2 separate approaches: 1) mapping at a food level for data collected using 24-hour recalls or diet diaries 2) mapping across food groups for data collected using FFQs.

# 3. Normalisation of data from different sources

In recent years, advances have been made in data analysis due to the volume of data being generated and available. However, one of the main challenges that remains during data analysis is the process of how to normalize the data, since data from the same domain (e.g.,dietary intake data) can be coded using heterogenous standards or systems. Data normalisation is a well-known task that can be defined as a procedure for organising data within a database, which acts to minimize redundancy (duplicate data) and prevents any issues stemming from database modifications such as insertions, deletions, and updates [16].

In relation to food data, data harmonisation can occur on multiple levels but is achieved initially by presenting data according to reliable classification and description systems [8]. During the data collection phase harmonisation efforts focus on following standardised protocols and best practice guidelines. Once data has been collected, cleaning the data to generate a dataset focuses on coding the data using a harmonised approach. For example, food consumption data from different countries, may be coded using different systems, with FoodEx2 [17; 18] (codes developed by EFSA), and LanguaL [19; 20] being 2 of the most widely used to describe food products. Due to the range of methods and ways in which dietary intake data can be collected and produced, data harmonisation between different sources most frequently occurs retrospectively [8]. As a result, harmonisation approaches must be flexible [8]. The ability to accurately harmonise dietary intake datasets retrospectively is dependent on heterogeneity of studies and data collection tools and requires time, access to appropriate expertise, and adequate methodologies [8]. Before



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harmonising different datasets, consideration should be given to the collection methods used and the how the data is handled. Domain experts should always consider the appropriateness of the data under consideration for their specific research question and whether the data from different sources are appropriate or possible to be merged.

Whilst Foodex2 and LanguaL are 2 of the most commonly used food classification systems, frequently dietary intake data is coded using nationally or locally developed food codes. This adds further complexity to the mapping process across similar datasets collected in different countries. Combining such datasets or even performing comparisons between the datasets is a time-consuming task as the process of mapping between the datasets must be completed manually. In recent years, much progress has been made in natural language processing (NLP) and machine learning (ML), where the focus has been on developing tools that can help the process of food data normalization. NLP has found applications in areas such as digital health interventions (21), extraction of dietary intake information from audio (22) and extraction of nutrient and food information from recipes (23). Whilst there are still improvements to be made in some of these techniques it is likely they will be utilised more widely in the near future.

Within the area of nutrition and dietary intake data, ML algorithms can be used to find unknown relations that exist between food entities and disease entities (24; 25). These relations are useful for informing hypotheses which can subsequently be tested in studies. The automated extraction of food information can be used to fill in missing values that appear in food databases such as food composition databases. Another application is the use of information extraction to extract food entities from dietary records for individuals (i.e., written as free-form text), and then map them on a nutrient level. This information can be combined and used by recommender systems.

## 3.1 Tools to support harmonisation of intake data

Several tools / resources exist to facilitate harmonisation of dietary intake data including StandFood, Foodbiz and others described in Table 3.1 below.

StandFood is a semi-automatic system for classifying and describing foods according to FoodEx2 (26). Briefly, this system consists of three approaches:



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1) a machine learning approach that classifies foods into four FoodEx2 categories, with two for single foods: raw and derivatives, and two for composite foods: simple and aggregated
2) a natural language processing approach and probability theory to describe foods
3) a combined approach that uses the results from the first and the second part by defining post-processing rules in order to improve the result for the classification part

StandFood is a time-efficient method of finding missing FoodEx2 codes for food composition data and food consumption data that are basic resources that need to be linked and combined for dietary assessment methods (26).

**Table 3.1 Existing resources to facilitate harmonisation of dietary intake data**

| Resource name | Resource type | Description |
|---|---|---|
| FoodOntoMap (27) | Mapping tool | Data normalisation tool which targets the domain of food and nutrition science, normalizing food concepts across three different ontologies (FoodOn, OntoFood, and SNOMED CT) and one semantic dataset. |
| FoodViz (28) | Visualisation tool for annotated text | A web-based framework used to present food annotation results from existing Natural Language Processing and Machine Learning pipelines in combination with different food semantic data models. |
| FoodOn (29) | Ontology | FoodOn is an open-source, comprehensive ontology resource composed of term hierarchy facets that cover basic raw food source ingredients, process terms for packaging, cooking and preservation, and an upper-level variety of product type schemes under which food products can be categorized. |
| MESCO (30) | Ontology | A novel ontology for traceability in meat supply chains (MESCO, Meat Supply Chain Ontology). MESCO represents |



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| | | |
|---|---|---|
| | | key concepts of the supply chain such as Activity, Actor, Food Product, Service Product, Lot and Process. |
| FoodBase (31) | Annotated corpus of food entities | Annotated corpus of food entities utilising recipe data to detect semantic similarities or differences between food concepts. |
| StandFood (26) | Food classifying and description tool | A Semi-Automatic System for Classifying and Describing Foods According to FoodEx2. |



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# 4. Report on mapping activities and their outcome

Food data can be collected using a variety of different methods however the data generated from them can be categorised into two basic levels: individual food and food group. In order to advance the capabilities of mapping across different food intake datasets, work on these two types of food intake data was undertaken simultaneously. The first aspect looked at mapping between food intake data collected at an individual food level. In other words, arising from food diaries or 24 hour recalls. The second approach focused on mapping across food intake data collected at a food group level, i.e., using food frequency questionnaires (FFQs). The tasks undertaken to advance the mapping capabilities between dietary intake data collected at either an individual food or food group level are described below.

## 4.1 Dietary intake data collected at food level

*Overview of activities undertaken*

The focus of the first approach was on coding food consumption data from several countries to the FoodEx2 code. The unharmonized food consumption data came from the EU Menu project, where the food products have been manually coded with FoodEx2 codes. Three use cases (UC) were performed on this data:

**UC1:** Match n= 120 food items using their English names and nutrient profiles with the corresponding FoodEx2 terms and facets

**UC2:** Match n= 120 recipes with their ingredients using their English names and nutrient profiles with the corresponding FoodEx2 terms and facets

**UC3:** Match food intake data with corresponding food composition data using only the English food names

*Extension of the StandFood Method*

In order to perform automatic data normalization for UC1 and UC2, the computational linguistics method, StandFood (developed as a part of the ERA-Chair ISO-FOOD project) has been extended [26]. In brief, the StandFood method takes a food name description as input data, performs linguistics analysis of the food name, and then links it to the same food product that exists within



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the FoodEx2 dataset. The outcome is the list term that is assigned to the food product. The StandFood performance is related to the description level of the food name. In simple terms, the better the food description the better the matching results possible. For the purpose of this task, we extended StandFood with additional features (see Figure 4.1), consisting of three vertical pillars.

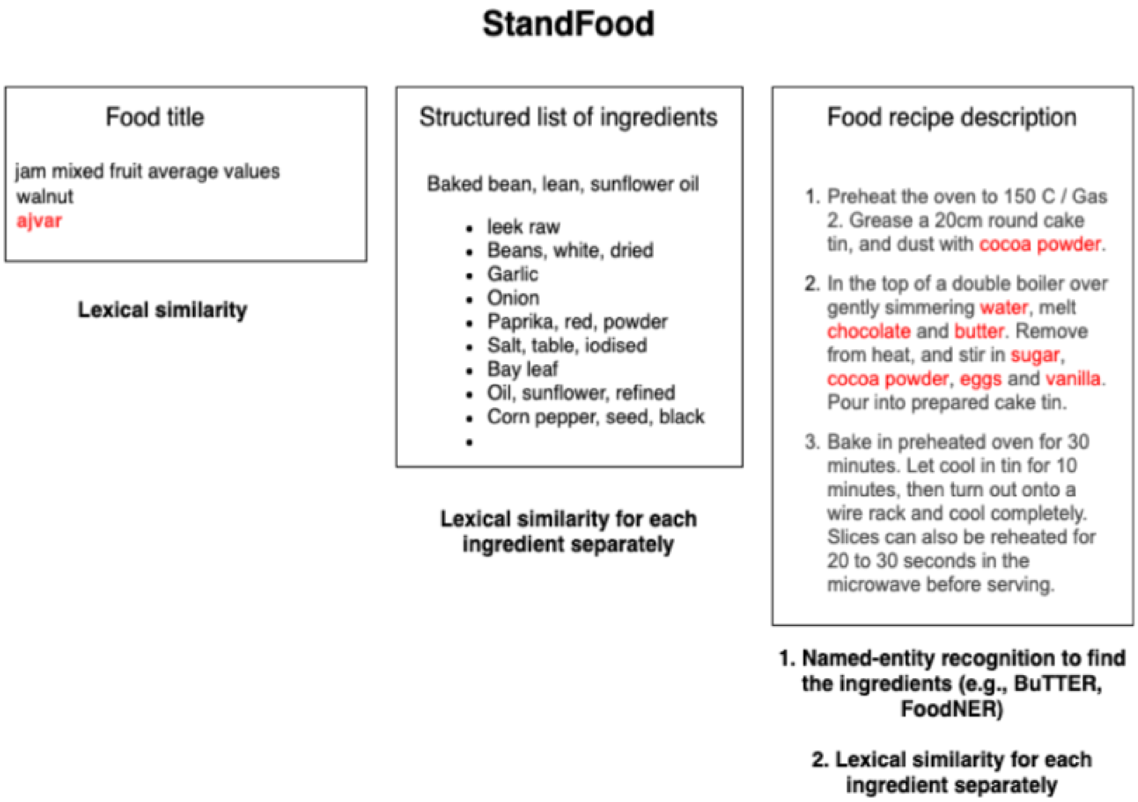


**Figure 4.1. The StandFood pipeline**

The first pillar is employed in cases whereby there is a good food product name. Using lexical similarity, the StandFood method will find the corresponding food product in FoodEx2 datasets, if it exists. However, there are recipes and traditional food products (e.g., ajvar which is a Serbian roasted red pepper relish) that are within dietary intake datasets collected at a national level across Europe that do not exist in the FoodEx2 database. In order to effectively code these food products/recipes StandFood requires a list of their ingredients to provide all FoodEx2 facets (Pillar 2). In these cases, all ingredients are coded together with the cooking processes associated with them. The second pillar is also used to code branded foods. The third pillar is used when the list



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of ingredients is not specified by the domain experts, but instead a description of the recipe's preparation is provided. Here, first named-entity recognition methods (NERs) should be utilized to extract the individual food entities from the text and then to code them in a similar manner as the second pillar. Further description of other NERs previously developed is provided within Deliverable 3.2 *Methodology for FNS data standardisation and interoperability*.

*Results from Use Cases*

The FoodEx2 dataset version 12 was used for this work, including four different food categories: namely, raw (r), derivative (d), simple (s) and composite (c) food products. All the food terms are structured in hierarchical order (from general terms and its descriptions to more specific ones) as defined by the FoodEx2 standard[1]. We have also tried to perform experiments where different hierarchies from the FoodEx2 dataset have been involved in the matching process that belong to the following types of terms (C – core term, E – extended term, and M – generic term) in the basic food list. The individual datasets and type of data used within each use case are listed below.

***UC1 – Match n= 120 food items using their English names and nutrient profiles with the corresponding FoodEx2 terms and facets***

***Data used:*** To perform the food matching exercise, a dataset from the Serbian dietary survey (collected during the pilot study in 2017) was prepared. This dataset consisted of 120 commonly consumed foods, divided into 12 food groups, which were identified based on the total quantity consumed in the adult population. Foods within the Serbian dataset are described in the Serbian and English languages and have data on 74 nutrients (macronutrients, vitamins and minerals). Foods are coded with FoodEx2 codes and facet descriptors from Exposure hierarchy.

***UC1 results***: The StandFood method takes the food product name and automatically generates one or more list terms from FoodEx2 that need to be selected/confirmed by a domain expert. This UC utilised the first pillar of the StandFood pipeline which resulted in 71% perfect matches. A 'perfect match' was defined as the code generated by the domain expert corresponding exactly with the code generated by the StandFood method. From these results it was apparent that the accuracy of the automatic matching is dependent on the translated English name of the food product (i.e., better translation equates to better results). Table 4.1 presents some examples of

[1] https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2015.EN-804



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perfect food matches. In the last example, the domain expert provided a code for "Common walnut", while the StandFood method provided a code for "Walnuts" that already existed in the FoodEx2 dataset.

**Table 4.1: Examples of 'perfect' matches**

| Food name | Domain code | StandFood generated code |
|---|---|---|
| Apple, whole, raw | A01DJ | A01DJ |
| Cheese, feta | A02RC | A02RC |
| Walnut* | A0DXG | A014R |

*FoodEx2 name: Common walnut

**Table 4.2: Examples of 'other' matches**

| Domain expert code and food name | Foodex2 food name | StandFood code and food name |
|---|---|---|
| A02YM Cheese, kachaval | Cheese, emmental | A02QE Cheese |
| A039E Clotted cream, Kaymak | Blended margarine | A02QR Clotted cream |
| A033L Honey | Honey, polyfloral | A033J Honey |
| A00KX Lettuce, green leaf | Lettuces (generic) | A0DKM Baby leaf lettuces |

Within table 4.2, examples of 'other' matches are displayed where the codes generated by the domain expert and the StandFood method are not perfect matches. However, on examination of the codes provided by StandFood it appears that the provided codes are correct; for example, the domain expert coded the clotted cream as blended margarine, whilst StandFood found a perfect match - A02QR Clotted cream. Furthermore, the cheese, kashkaval (typical cheese consumed within the Balkan region) was coded as Emmental by the domain expert, with the StandFood method suggesting the generic code for 'cheese', which is an acceptable code for this product and often used in food coding, when detailed information on the food product is missing. This UC example demonstrates that in many cases the English name of the food product is not correctly



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or completely translated from the colloquial or traditional name, which can confuse the automatic matching of food items, resulting in erroneous errors.

As well as exact matching at the food item level, the effect of different hierarchies of FoodEx2 on the automatic coding was examined. For this purpose, we select r, d, s, and c food products that belong to the following combinations of types of terms: E; C and E; or, C, E, and M. One example of this coding is the following:

- Domain expert: Milk cow whole 3/4 (FoodEx2: A02LY)
- StandFood (E) - cow milk whole - A02LY
- StandFood (C, E) - cow milk - A02LV
- StandFood (C, E, M) - cow milk - A02LV

From this example, it appears that the perfect match (A02LY) is only obtained when the extended term (E) hierarchy is used, however in the other two cases, the match found is only one level away in the hierarchy.

In addition to the StandFood approach, a ML approach was also attempted for UC1, where a ML based multi-class classification method for mapping nutrient profiles to FoodEx2 codes was tested. The training of the ML method was performed on European FCDBs, considering energy, macronutrients, sugar, water, vitamins (folate, riboflavin, thiamine, vitamin B12, vitamin B6, vitamin C), minerals (potassium, magnesium, sodium, phosphorous, zinc) as feature variables. The ML method offered three possible FoodEx2 terms as solutions. There are several weaknesses associated with this method. Firstly, the model is learning the 'noise' (poor coding choices) that are present in the manual coding. The ML method providing a poor solution as a result of noise by the manual coding is illustrated in the following example:

- Domain expert: A039E Clotted cream, Kaymak (FoodEx2 name: Blended margarine)
- StandFood: A02QR Clotted cream
- ML: A039E Blended margarine

Therefore, it is evident that the errors made by domain experts will also be adopted when a ML approach is used. Secondly, the ML approach cannot recognize FoodEx2 codes that are not present in the training data set. The percentage of perfect matches when using the ML approach was approximately 55%.



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***UC2 – Match n= 120 recipes with their ingredients using their English names and nutrient profiles with the corresponding FoodEx2 terms and facets***

***Data used:*** Commonly consumed recipes within the Serbian national Food consumption survey were selected for this use case. Foods from these recipes are described with names in Serbian and English languages and with 74 nutrients (macronutrients, vitamins and minerals), as described above. Foods within recipes are coded with Foodex2 codes from the Exposure Hierarchy. Where applicable, the facet F28 Process, is added to some of the foods which reflects the process applied to foods used in the recipe. Some food names suggested the applied process without requiring additional coding.

***Results:*** A list of 120 recipes with their ingredients was prepared for this UC. The second pillar of the StandFood pipeline, where each ingredient is matched separately, alongside their cooking processes (processes from FoodEx2 hierarchy + their past participle form) was used. The StandFood method appears to work relatively well for ingredients (Figure 4.3, where the yellow highlighted rows indicate perfect matches. Rows highlighted in green indicate an example of when the domain expert should select the correct match from the multiple automatically generated possible matches. The red highlighted row indicates an example of when the StandFood method identified a perfect match, but the domain expert missed this).

| | Food ingredient | StandFood name | StandFood FoodEx2 code | FoodEx2 code | pro_code | process name | RS process |
|---|---|---|---|---|---|---|---|
| 1 | leek raw | leeks | A00SB | A00SB | NA | NA | A00SB#F28.A07GX |
| 2 | beans white dried | beans dry and similar.mung beans dry.broad beans dry.lablab beans dry.yardlong beans dry.stink beans dry | A012S.A013D.A01: | A012T | A07KG | dried | A012T#F01.A05GX$F28.A07GL$F28.A07GX$F28.A07MS |
| | garlic | garlic | A00GZ | A00GZ | NA | NA | A00GZ#F28.A07GX |
| 4 | onion | onions | A00HC | A00HC | NA | NA | A00HC#F28.A07GX |
| 5 | paprika red powder | paprika powder | A019L | A019L | NA | NA | A019L#F28.A07GX$F19.A07PH |
| 6 | salt table iodised | salt iodised | A042R | A042R | NA | NA | A042R#F19.A07PQ$F28.A07GX |
| 7 | bay leaf | leaves | A0EST | A00VX | NA | NA | A00VX#F19.A07PN$F28.A07GX |
| 8 | oil sunflower refined | olive oil refined | A036R | A037D | NA | NA | A037D#F10.A07XK$F19.A16RP$F28.A0C07$F19.A07PR$F28.A07GX |
| 9 | corn pepper seed black | black pepper | A019C | A018Y | NA | NA | A018Y#F10.A166Z$F19.A07PL$F28.A07GX |
| 10 | clotted cream kaymak | clotted cream | A02QR | A02ML | NA | NA | A02ML#F19.A16RP$F10.A077A$F28.A07GX |
| 11 | phyllo wheat flour | wheat flour | A003X | A16FH | NA | NA | A16FH#F19.A16SA$F28.A07GX |
| 12 | cheese white fresh unripene | fresh uncured cheese | A02QF | A02QG | A0C6F | ripened | A02QG#F10.A077A$F10.A07XM$F10.A166Y$F19.A16RP$F28.A07GX |
| 13 | egg hen whole raw | hen egg mixed whole dried | A031X | A031R | NA | NA | A031R#F28.A07GX$F19.A07PQ |
| 14 | salt table iodised | salt iodised | A042R | A042R | NA | NA | A042R#F19.A07PQ$F28.A07GX |

**Figure 4.3: Matching recipe's ingredients to FoodEx2**

Since recipe's ingredients can't be used to describe all of the FoodEx2 facets, the cooking process also needs to be identified. To achieve this, the cooking processes found in the food name



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description were also extracted and coded. Figure 4.4 provides an example of the process evaluation results, where the green rows correspond to examples where the cooking process coded by the domain experts is also found by StandFood, while the yellow rows correspond to examples where the cooking process is available in the food description name, extracted by StandFood, but the domain experts have not coded this information.

| name | foodex2 code | process | Foodex2 code |
|---|---|---|---|
| macaroni, spaghetti, boiled | A007P#F02.A06CX$F28.A07GL$F28.A07KG | boiled | A07GL |
| oats, rolled | A00DH#F02.A068G$F27.A000G$F28.A07LH | rolled | A07LH |
| pork, cured, bacon | A022X#F02.A06AP$F27.A01RG$F28.A07KD | cured | A07KD |
| tuna, in oil, canned | A0FBT#F02.A0EMS$F19.A07PH$F19.A07PJ$F27.A02DX$F28.A0BYP | canned | A0BYP |
| egg, whole, boiled | A032B#F02.A06BX$F27.A031G$F28.A07GL$F28.A07LC | boiled | A07GL |
| water, carbonated, vrnjci | A03DX#F02.A06CA$F10.A06HS$F27.A03DX$F28.A07JN | carbonated | A07JN |
| water, knjaz milos, carbonated | A03DS#F02.A06CA$F10.A06HS$F27.A03DS$F28.A07JN | carbonated | A07JN |
| chicken breast, grilled | A01SP#F01.A057Z$F02.A0BYZ$F27.A01SP$F28.A07GZ | grilled | A07GZ |
| jam, mixed fruit (average values) | A01NH#F02.A0EMA$F04.A04RK$F04.A0BY6$F08.A032K$F10.A077J$F28.A0E | mixed | A0CRL |
| hazelnut, dried | A014L#F01.A0CFH$F02.A066R$F27.A014L | dried | A0C0C |
| rice, white, long-grain, cooked | A001F#F01.A059Z$F02.A066Q$F27.A001F$F28.A07GL$F28.A07LK | cooked | A07HF |
| pepper, pickled | A00ZJ#F02.A0ELK$F27.A00JA$F28.A0C0P | pickled | A07KC |
| potato chips, plain, salted | A011L#F02.A0EPT$F28.A07GV | salted | A07JP |
| ham, cooked, in casing | A023K#F02.A06AP$F19.A16SA$F27.A01RG$F28.A07JP$F28.A0BA1 | cooked | A07HF |
| chicken, cooked in water | A01SP#F01.A057Z$F02.A0BYZ$F27.A01SP$F28.A07GL | cooked | A07HF |
| egg, fried, salted | A032C#F02.A06BX$F27.A031F$F27.A031G$F28.A07GR$F28.A07LC | fried | A07GV |
| egg, fried, salted | A032C#F02.A06BX$F27.A031F$F27.A031G$F28.A07GR$F28.A07LC | salted | A07JP |
| bread, wheat, white, toasted | A004Y#F02.A06CN$F04.A001M$F10.A07XK | toasted | A07HC |
| pork, loin fillet, smoked | A022T#F02.A06AP$F27.A01RG$F28.A07KD | smoked | A16ET |

**Figure 4.4: A process evaluation results.**

To summarize, out of 120 recipes 113 matches were found by the StandFood tool. For the 133 matches, 39 were correct, while the other 74 matches were incorrect.



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**UC3 - Match food intake data with corresponding food composition data using only the English food names**

**Data used**: For UC3, a list of 45 Dutch NEVO recipes and their ingredients was prepared. The selected 45 recipes are of different complexity. There are 4 complex recipes, 2 mixed dishes (one with and one without added fat), 6 nested recipes, 2 recipes based on label data, 15 simple recipes, 3 cookbook recipes, 2 recipes used in multiple recipes, and the rest of them were selected randomly. With respect to the number of ingredients, there are 14 recipes with 2 ingredients, 5 recipes with 3 ingredients, 6 recipes with 4 ingredients, 3 recipes with 5 ingredients, 5 recipes with 6 ingredients, while all the other recipes have more than 6 ingredients with the largest one accounting for 19 ingredients.

***Results:*** A tool that uses a linear programming approach to resolve the problem of identifying amounts of ingredients from information of selected nutrients for the recipes was implemented. This tool returned promising results with 43 out of 45 recipes correctly predicted with an average error of less than 1.5 g per ingredient. An example of successful prediction is illustrated in Figure 4.5. From the figure it is evident that the predicted ingredient amounts almost perfectly match the targeted grams with an average error of 0.37g using the selected nutrients.

| code recipe | recipe name | average error | maximal error |
|---|---|---|---|
| 192 | Fruit mixed dried | 0.366666667 | 0.366666667 |
| ------------------ | | | |
| ingredient | target_gram | predicted_gram | |
| Apples dried | 100 | 100.3666667 | |
| Prunes | 100 | 100.3666667 | |
| Pear dried | 100 | 99.63333333 | |
| Apricots dried | 100 | 99.63333333 | |
| ------------------ | | | |
| nutrient code | target_value | calculated_value | predicted_value |
| CHO | 234 | 234 | 233.9486667 |
| ENERCJ | 4581.1 | 4581.1 | 4580.158033 |
| FASAT | 0.096 | 0.098 | 0.098359333 |
| FAT | 0.5 | 0.5 | 0.501833333 |
| FIBT | 49.7 | 49.7 | 49.70623333 |
| NA | 55 | 55 | 54.945 |
| POLYL | 0 | 0 | 0 |
| PROT | 11 | 11 | 10.989 |
| STARCH | 31 | 31 | 30.989 |
| SUGAR | 203 | 203 | 202.9596667 |

**Figure 4.5: Results for recipe "Fruit mixed dried".**



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One issue identified during UC3 was observed for the data which provided incorrect target nutrient values for the recipe. This was due to the inclusion of some analytical data in the published NEVO dataset instead of values calculated by recipe calculation. An example of this issue is presented in Figure 4.6. The target value represents the nutrient values obtained from the NEVO dataset for the selected recipe, while the calculated value represents the values that were calculated from the nutrients of all ingredients of the recipe. The calculation is done by summing the amounts of individual nutrients over all the ingredients. For each ingredient the nutrient value (per 1 gram) from the NEVO dataset is multiplied by the target gram from the recipe. For this reason, in the experiments, only calculated nutrient values were used. In future, a corrected dataset consisting solely of values created by recipe calculation will be created.

| | | |
|---|---|---|
| code recipe | recipe name | |
| 284 | Yoghurt low fat w fruit | |
| ---------------- | | |
| ingredient | target_gram | |
| Yoghurt low fat | 85 | |
| Sugar granulated | 9 | |
| Fruit in own juice tinned | 6 | |
| ---------------- | | |
| nutrient code | target_value | calculated_value |
| CHO | 14.207 | 13.0195 |
| ENERCJ | 310.68 | 297.95489 |
| FASAT | 0.026 | 0.123 |
| FAT | 0.04 | 0.18994 |
| FIBT | 0.06 | 0.099 |
| NA | 48 | 36.336 |
| POLYL | 0 | 0 |
| PROT | 3.433 | 3.52715 |
| STARCH | 1.067 | 0 |
| SUGAR | 13.14 | 13.0195 |

**Figure 4.6: Differences for recipe "Yoghurt low fat w fruit" in target and calculated nutrient values**

The only recipes for which the tool was not able to correctly predict ingredients' amounts were the ones that contained ingredients which had the same values for all selected nutrients. In such cases it is impossible to identify the correct amounts (for such ingredients the average value of sum of targeted amounts is set). An example of such a recipe is shown in Figure 4.7. The only solution would be the usage of nutrients which would help differentiate ingredients according to nutrient values.



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| code recipe | recipe name | average error | maximal error |
|---|---|---|---|
| 470 | Chinese noodle dish Bami goreng without egg | 18.66717288 | 118.1032627 |
| ------------------ | | | |
| ingredient | target_gram | predicted_gram | |
| Pasta white average boiled | 750 | 762.6293495 | |
| Pork stewing meat raw | 250 | 240.443468 | |
| Onions boiled | 225 | 106.8967373 | |
| Leek boiled | 105 | 106.8967373 | |
| Ham shoulder medium fat boiled | 100 | 106.8967373 | |
| Beans French boiled | 84 | 106.8967373 | |
| Bean sprouts boiled | 80 | 106.8967373 | |
| Cabbage white cooked | 79 | 106.8967373 | |
| Cabbage Chinese boiled | 60 | 75.70955278 | |
| Oil soy | 45 | 44.99269114 | |
| Soy sauce sweet | 28 | 31.92381079 | |
| Celery leaves fresh | 20 | 31.92381079 | |
| Juice lemon fresh | 6 | 3.6485069 | |
| Salt not fortified with iodine | 3 | 2.34838657 | |
| ------------------ | | | |
| nutrient code | target_value | calculated_value | predicted_value |
| CHO | 482.605 | 248.5132 | 248.7617132 |
| ENERCJ | 13022.13255 | 8980.07615 | 8987.884316 |
| FASAT | 14.0928 | 14.09878 | 14.08468122 |
| FAT | 68.7758 | 68.76825 | 68.83701825 |
| FIBT | 26.057 | 26.065 | 26.091065 |
| NA | 3580.3052 | 3580.3055 | 3583.885806 |
| POLYL | 0 | 0 | 0 |
| PROT | 121.11 | 117.4341 | 117.5515341 |
| STARCH | 394.158 | 215.2252 | 215.4404252 |
| SUGAR | 88.447 | 33.288 | 33.321288 |

**Figure 4.7: Target and predicted grams are not matched due to inseparability between ingredients' nutrient values.**

*Summary of results from Use Cases*

Within the mapping activities, we tried to match different food items and recipes from existing datasets to corresponding FoodEx2 terms and facets. For this task two approaches were applied. The first approach used StandFood to perform matching based on the English food names. Using a test dataset, it returned an accuracy level of >70% for individual food items, and 32% for recipes. The second approach used a ML-based multi-class classification method to perform mapping based on food nutrient profiles. This method achieved 55% accuracy for individual food items. It was not tested for recipes as the required nutrient profiles were not available within the dataset. For the purposes of this activity, the matching of the ingredient names within recipes and matching nutrients profiles were performed in advance, so a perfect match was provided. A tool based on a linear programming approach was developed that was able to predict the amount of ingredients on the test examples with accuracy of above 95% with an average error of <1.5g per ingredient. All work was completed using the English food names within datasets, this may limit its future use in certain datasets which have been collected in other languages. The datasets used within this task were from Serbia thus the foods described within them were commonly



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consumed within this country however these foods and the way in which they were described may not be applicable to datasets from other countries. This mapping system will be further tested within the Demonstrators in WP5. The quality of the identified matches within each of these Use cases could be further evaluated in future work.

*Gaps identified*

During the activities several gaps were identified:

- Manually coding food items with Foodex2 codes, even by subject matter experts is very subjective, which results in coding variations between different datasets. This calls for a unified and more automatic way of coding.
- Errors made by the experts influence the ability of the advanced ML-based approaches to correctly learn the features to make a correct prediction. Therefore, efforts should be made to minimise the number of errors in existing datasets.
- Translation of names of traditional dishes and colloquial names for specific foods requires a more standardized approach due to the variation in names for similar food items across countries in Europe
- In order to facilitate the use of nutrient profiles for various AI-based activities, this data needs to be available with minimal missing values across various nutrients and acquired for as many foods as possible.
- To improve the quality of automatic processing of complex foods (e.g.,recipes and branded foods) a standardized way of describing the ingredients and their amounts should be prescribed and followed.
- In order to apply the StandFood method and obtain the FoodEx2 codes for any type of data, the input data should be in a predefined standardised format. A detailed description of the format for the input data is given in Appendix A.

*Future work and use in FNS-Cloud*

The approaches presented in this deliverable are to be implemented as as web services within WP3 of the FNS-Cloud project. Furthermore, it is planned to use the developed approaches within the Food Labelling Demonstrator in WP5.



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## 4.2 Dietary intake data collected at a food group level

*Overview of activities undertaken*

The aim of the developed mapping system for FFQs is to facilitate the re-use of previously collected FFQ data by enabling different datasets to be merged together thus creating larger datasets suitable for answering new research questions. In order to create a mapping system, a list of eight existing FFQs previously used was compiled; namely, EuroGene, EPIC (UK based FFQ) [(32; 33)], Scottish Collaborative Group [(34)] (https://www.foodfrequency.org/), Food4Me [(35)], eNutri (based on Food4Me) [(36)], Feel4Diabetes, the National Health and Examination survey FFQ (NHANES -American FFQ) (https://www.cdc.gov/nchs/nhanes/index.htm), Japanese FFQ.

The overall aim of this activity was to generate a visual map of previously used FFQs alongside guidelines of how to map across these FFQs. This activity was achieved by undertaking the following series of steps:

1. Map and compare the macro and micronutrient compositions per 100g across each food/food group in different FFQs
2. Map and compare the portion sizes across each food/food group in different FFQs
3. Map and compare the response categories for frequency of consumption for each FFQ
4. Test the effectiveness of the above mapping on individual food group intakes by completing a case study using two mapped FFQs.

*Development of mapping across FFQs*

An overview of each FFQ was compiled containing the list and number of food groups, the list of food items contained within each food group, the timeframe response options for frequency of consumption questions, and, the timeframe each FFQ captured (Figure 4.8). A brief description of each of these parameters is described below.



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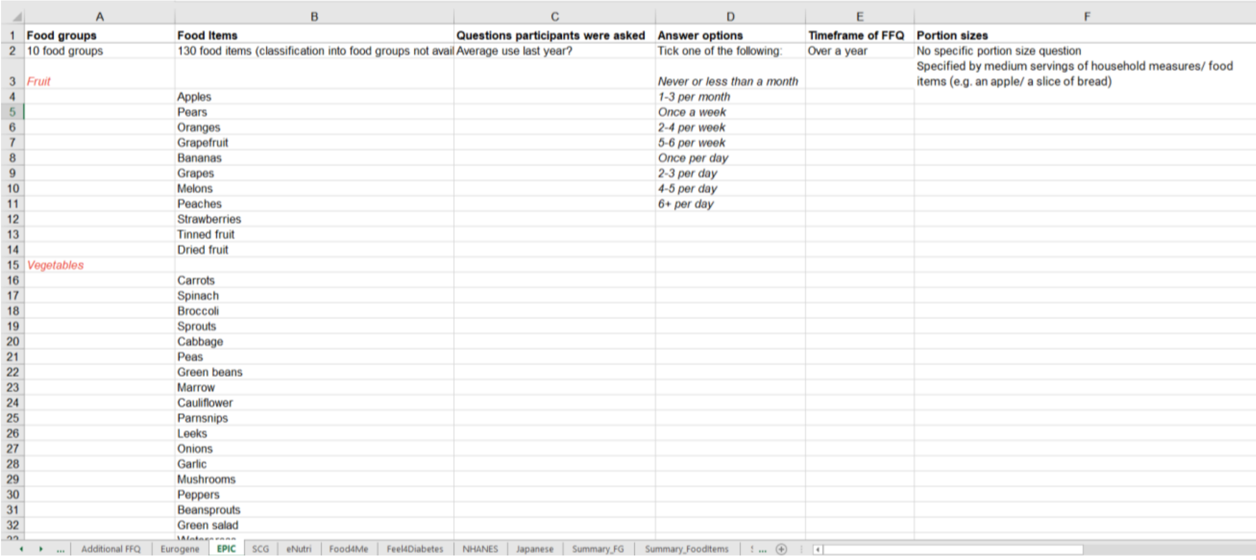

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Food groups** | **Food Items** | **Questions participants were asked** | **Answer options** | **Timeframe of FFQ** | **Portion sizes** |
| 2 | 10 food groups | 130 food items (classification into food groups not avail | Average use last year? | Tick one of the following: | Over a year | No specific portion size question |
| 3 | *Fruit* | | | *Never or less than a month* | | Specified by medium servings of household measures/ food items (e.g. an apple/ a slice of bread) |
| 4 | | Apples | | *1-3 per month* | | |
| 5 | | Pears | | *Once a week* | | |
| 6 | | Oranges | | *2-4 per week* | | |
| 7 | | Grapefruit | | *5-6 per week* | | |
| 8 | | Bananas | | *Once per day* | | |
| 9 | | Grapes | | *2-3 per day* | | |
| 10 | | Melons | | *4-5 per day* | | |
| 11 | | Peaches | | *6+ per day* | | |
| 12 | | Strawberries | | | | |
| 13 | | Tinned fruit | | | | |
| 14 | | Dried fruit | | | | |
| 15 | *Vegetables* | | | | | |
| 16 | | Carrots | | | | |
| 17 | | Spinach | | | | |
| 18 | | Broccoli | | | | |
| 19 | | Sprouts | | | | |
| 20 | | Cabbage | | | | |
| 21 | | Peas | | | | |
| 22 | | Green beans | | | | |
| 23 | | Marrow | | | | |
| 24 | | Cauliflower | | | | |
| 25 | | Parnsnips | | | | |
| 26 | | Leeks | | | | |
| 27 | | Onions | | | | |
| 28 | | Garlic | | | | |
| 29 | | Mushrooms | | | | |
| 30 | | Peppers | | | | |
| 31 | | Beansprouts | | | | |
| 32 | | Green salad | | | | |



**Figure 4.8: Overview of food groups, food items, frequency response options and portion sizes in individual FFQs**

### The list and number of food groups

The total number of food groups within FFQs included ranged from 10 – 19 (Table 4.3). Many similar food groups exist across the FFQs, however variation does exist. For example, in the Japanese FFQ food groups include “Green-Yellow Vegetables”, “Light-coloured Vegetables”, “Pulses”, “Mushroom” and “Seaweed”, conversely, the majority of the other FFQs only include a single food group named “Vegetables''.

### A list of food items under each food group

There was much greater variation between FFQs in the individual food items included under each food group than there was between food groups themselves. Many food items listed in one FFQ may be missing from other FFQs. Although many inter-FFQ food items are similar, collapsing these into single food groups to facilitate merging cannot be achieved as easily as the food groups. Comparison of individual food items listed between each FFQ is given in Appendix B.

### Timeframe response options for frequency of consumption questions

The phrasing of questions and timeframe response options provided to participants regarding food item consumption was captured to give context to the level of consumption. The manner in which frequency of consumption was asked varied across FFQs with some collecting information on weekly consumption whilst others evaluated daily consumption.



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### Time Frame considered

The time frame that is considered must be taken into account when comparing FFQs as seasonal variation of dietary intake does exist. Considerable variation was observed in the timeframe captured across FFQs with n=3 asking participants to consider consumption over the past year, n=4 over the past month, and n=1 over the past 2-3 months.

### Assessment of portion sizes

Portion size information can be captured in a number of ways. Allowing participants to specify their portion size through use of defined small, medium and large descriptors or use of food images can facilitate more accurate estimates during retrospective reporting [37]. The Food4Me and eNutri FFQs provided participants with 3 food images of varying sizes (representing small, medium and large portions) for each food item chosen. The remaining FFQs used household measures (e.g.,teaspoons) and average portions (e.g.,1 slice of bread).

### Visualization of the mapping across FFQs

An excel database to visualize the similarities across each of the individual FFQ food groups was created. Each FFQ was presented in a single column with food group names displayed in red text and individual food items contained within these groups listed underneath. Common food groups across the FFQs were presented in the same row. Food group names which were similar but not exact matches were place either a row above or below these. For example, the food groups “Fruit” and “Vegetables” were common throughout five of the FFQs and were added to the spreadsheet on the same row (Figure 4.8). The NHANES was the only FFQ which used the combined food group name of “Fruits/Vegetables” thus this food group was added one row above the “Fruit” food group. This process was repeated for all remaining food groups to allow for easy visualization of the common food groups across the different FFQs.

Next, each food item was added underneath their respective food group and the same process repeated to align common foods. Food items which were common within each food group across the FFQs were placed in the same row with blanks left to accommodate food items which may not have been included in all FFQs. Considerably more variation existed between each FFQ food item compared to the food group list (Figure 4.8).



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**Table 4.3. Mapping of food group categories across FFQs**

| EPIC | SCG | eNutri | Food4Me | Feel4Diabetes | NHANES | Japanese |
|---|---|---|---|---|---|---|
| (n=10) | (n=19) | (n=11) | (n=11) | (n=16) | (n=10) | (n=14) |
| Fruit | Fruit | Fruit | Fruit | Fruit | Fruit/Vegetables | Fruits |
| Vegetables | Vegetables | Vegetables | Vegetables | Vegetables | | Yellow-green vegetables |
| | | | | | | Light-coloured vegetables |
| | | | | | | Pulses |
| | | | | | | Mushrooms |
| | | | | | | Seaweed |
| Meat and Fish | Meats | Meat and Fish | Meat and Fish | Meat and Vegetarian dishes | Meat/Fish/Protein | Meats |
| | | | | Cold cuts | | |
| | Fish | | | | | Fish and Shellfish |
| | Eggs | | | | | |
| Cereals | Breakfast Cereals | Cereals | Cereals | Bread and other cereals | Bread and Cereal | Cereal |
| Bread and Savoury Biscuits | Bread | Bread and Savoury Biscuits | Bread and Savoury Biscuits | | | |
| Potatoes, Rice, Pasta | Potatoes, Rice, Pasta | Potatoes, Rice, Pasta | Potatoes, Rice, Pasta | | Pasta and Rice | Potatoes |
| Dairy Products & Fats | Milk | Dairy Products & Fats | Dairy Products & Fats | Milk | Dairy foods | Eggs and Dairy Products |
| | Cream and Yoghurt | | | Cheese | | |
| | Cheese | | | Cream | | |
| | | | | Meals and snacks | Mixed dishes | |
| Soups, sauces, spreads | Savoury foods, soups, sauces | Soups, sauces, spreads | Soups, sauces, spreads | Spreads | | |
| | Spreads and sugar | Fats and Spreads | Fats and Spreads | Cooking fats/ oils | Condiments | Miscellaneous |
| | | | | Salad dressing | | |



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| | | | | | | |
|---|---|---|---|---|---|---|
| Sweets and Snacks | Chocolate, Sweets, Nuts, Crisps | Sweets and Snacks | Sweets and Snacks | Sugar, honey, sweets | Snack foods | Confectioneries |
| | Biscuits | | | | | |
| | Puddings | | | Sweet patisseries, ice cream, puddings, chocolate | Dessert foods | |
| | Cakes | | | | | |
| | | | | Fast Foods | | |
| Drinks | Beverages and soft drinks | Drinks | Drinks | Beverages | Beverages | Beverages |
| | Alcoholic Drinks | | | | | |



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| | B | C | D | E | F |
|---|---|---|---|---|---|
| 1 | EPIC | SCG | eNutri | Food4me | NHANES |
| 2 | | | | | *Fruit/Vegetables* |
| 3 | *Fruit* | *Fruit* | *Fruit* | *Fruit* | |
| 4 | Apples | Apples | Apples | Apples | Apples |
| 5 | Pears | Pears | Pears | Pears | Pears |
| 6 | Oranges | Citrus Fruits | Oranges, satsumas, mandarins | Oranges, satsumas, mandarins | Oranges, tangerines, tangelos |
| 7 | Grapefruit | | Grapefruit | Grapefruit | Grapefruit |
| 8 | Bananas | Banana | Bananas | Bananas | Banans |
| 9 | Grapes | | Grapes | Grapes | Grapes |
| 10 | Melons | | Mango, melon | Mango, melon | Melon |
| 11 | Peaches | | Peaches/plums/apricots/nectarines | Peaches/plums/apricots/nectarines | Peaches, nectarines, plums |
| 12 | Strawberries | | Strawberries, raspberries, cherries | Strawberries, raspberries, cherries | Strawberries |
| 13 | | | Kiwis | Kiwis | |
| 14 | Tinned fruit | Tinned fruit | Tinned, stewed fruit peaches | Tinned, stewed fruit peaches | |
| 15 | Dried fruit | | Dried fruit eg raisins, prunes | Dried fruit eg raisins, prunes | Dried fruit |
| 16 | | | | | Pineapple |
| 17 | | Fresh fruit salad | | | |
| 18 | | | | | |
| 19 | | | | | |
| 20 | *Vegetables* | *Vegetables* | *Vegetables* | *Vegetables* | |
| 21 | | | | | |
| 22 | Carrots | Carrots | Carrots | Carrots | Carrots |
| 23 | | | | | |
| 24 | Tomatoes | | Tomatoes | Tomatoes | Tomatoes |
| 25 | | Other root vegetables | | | |
| 26 | | | | | Sweet potatoes/ yams |
| 27 | | | Butternut squash, pumpkin | Butternut squash, pumpkin | Summer squash |
| 28 | Parnsnips | | Parsnips, turnips, swedes, celeriac, fennel | Parsnips, turnips, swedes, celeriac, fennel | |
| 29 | Beetroot | | Beetroot | Beetroot | |
| 30 | Cauliflower | | Cauliflower | Cauliflower | Cauliflower or brussel sprouts |
| 31 | | | Brussels sprouts | Brussels sprouts | |

Additional FFQ | Eurogene | EPIC | SCG | eNutri | Food4Me | Feel4Diabetes | NHANES | Japanese | Summary_FG | Summary_FoodItems

**Figure 4.8: Visualization of common foods within each food group across different FFQs**

*Comparison Exercise*

In order to test the effectiveness of the developed FFQ mapping system, a comparison exercise was conducted using 2 example FFQs, namely, Food4Me and NHANES. Baseline Food4Me data from n= 210 participants (n= 30 from each country: Germany, Spain, Ireland, Greece, England, Netherlands, Poland) was re-entered into the NHANES FFQ. Where possible, food groups and food items that directly aligned between the FFQs were entered into the same food groups. Food groups that didn't directly align were either mapped to an alternative food group or merged with other food items to another food group. In some cases, where no appropriate food group was available, the group was dropped and not re-entered into the NHANES FFQ. An overview of this mapping is given in Figure 4.9.



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| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | **Food4me** | **NHANES** | **Guidelines** | | |
| 2 | | *Fruit/Vegetables* | | | |
| 3 | *Fruit* | | | | |
| 4 | Apples | Apples | | | |
| 5 | Pears | Pears | | | |
| 6 | Oranges, satsumas, mandarins | Oranges, tangerines, tangelos | | | |
| 7 | Grapefruit | Grapefruit | | | |
| 8 | Bananas | Banans | | | |
| 9 | Grapes | Grapes | | | |
| 10 | Mango, melon | Melon | | | |
| 11 | Peaches/plums/apricots/nectarines | Peaches, nectarines, plums | | | |
| 12 | Strawberries, raspberries, cherries | Strawberries | | | |
| 13 | Kiwis | | not in NHANES drop | | |
| 14 | Tinned, stewed fruit peaches | | not in NHANES drop | | |
| 15 | Dried fruit eg raisins, prunes | Dried fruit | | | |
| 16 | | Pineapple | not in Food4me drop | | |
| 17 | *Vegetables* | | | | |
| 18 | Carrots | Carrots | | | |
| 19 | Tomatoes | Tomatoes | | | |
| 20 | | Sweet potatoes/ yams | not in Food4me drop | | |
| 21 | Butternut squash, pumpkin | Summer squash | | | |
| 22 | Parsnips, turnips, swedes, celeriac, fen | Mixed vegetables | map with NHANES mixed veg, calculate average from Food4me | | |
| 23 | Beetroot | | map with NHANES mixed veg, calculate average from Food4me | | |
| 24 | Olives | | map with NHANES mixed veg, calculate average from Food4me | | |
| 25 | Mushrooms | | map with NHANES mixed veg, calculate average from Food4me | | |
| 26 | Cauliflower | Cauliflower or brussel sprouts | calculate average from Food4me | | |
| 27 | Brussels sprouts | | calculate average from Food4me | | |

**Figure 4.9: Overview of mapping across NHANES and Food4Me FFQs**

*Results*

Analysis is being conducted to test the effect of the mapping system that was developed on the subsequent food group and nutrient intakes of the population. To examine differences in food group intakes between the two FFQs, the food items in the Food4Me FFQ and NHANES FFQ were aggregated into 31 broad food groups [35]. An example of the comparison of mean daily intakes for Irish participants, estimated from the two FFQs for the 31 food groups are presented in Table 4.4. Statistical analyses were performed using SPSS version 26.0 (IBM Corp, Armonk, NY, USA). Mean food group intakes and standard deviations were calculated for participants for the original Food4Me FFQ entries and re-entered NHANES FFQ. Differences in mean total intakes (g/day) were assessed using paired 2-sample *t* tests. Half of the sample were male (50%) and the mean age was 41.8 years (standard deviation 14.01).



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**Table 4.4. Mean food group intakes for Irish participants (N= 30)**

| **Food Groups** | **NHANES mean intakes** | | **Food4Me mean intakes** | | **p-value*** |
|---|---|---|---|---|---|
| | **Mean (g/day)** | **SD (g/day)** | **Mean (g/day)** | **SD (g/day)** | |
| Breakfast cereals and porridge | 96.10 | 93.41 | 84.08 | 85.52 | 0.211 |
| Bread, rolls, crackers and wraps | 113.65 | 73.71 | 128.91 | 95.75 | 0.056 |
| Potatoes and potato products | 96.07 | 56.68 | 95.61 | 61.06 | 0.889 |
| Rice, pasta, grains and starches | 112.06 | 67.80 | 83.66 | 60.78 | **0.002** |
| Savory dishes | 52.41 | 50.74 | 42.90 | 36.88 | **0.009** |
| Red meat | 40.21 | 42.26 | 40.57 | 40.54 | 0.849 |
| Bacon | 3.03 | 3.63 | 2.28 | 2.58 | **0.002** |
| Meat products | 30.66 | 27.33 | 31.65 | 24.73 | 0.692 |
| Poultry | 42.60 | 29.81 | 36.82 | 27.49 | **<0.001** |
| Fish, fish dishes and fish products | 48.43 | 42.26 | 62.70 | 44.80 | **<0.001** |
| Milk | 291.65 | 309.41 | 297.67 | 274.53 | 0.754 |
| Ice cream, creams and desserts | 24.05 | 22.32 | 19.85 | 20.09 | **<0.001** |
| Yoghurt | 47.32 | 48.92 | 50.44 | 55.31 | 0.200 |
| Cheese | 26.93 | 27.92 | 26.33 | 26.17 | 0.532 |
| Eggs and egg dishes | 56.95 | 73.78 | 59.66 | 82.97 | 0.327 |
| Fats and oils (e.g., butter, low fat spreads, hard cooking fats) | 21.11 | 15.17 | 25.60 | 15.93 | **0.002** |
| Biscuits | 68.02 | 102.04 | 58.80 | 101.54 | 0.037 |
| Cakes, pastries and buns | 30.44 | 36.87 | 27.05 | 35.66 | **<0.001** |
| Confectionary and savory snacks | 35.38 | 83.08 | 32.89 | 72.63 | 0.325 |
| Nuts and seeds, herbs and spices | 4.78 | 8.22 | 4.48 | 8.18 | 0.079 |
| Soups, sauces and miscellaneous foods | 63.41 | 56.10 | 94.01 | 70.37 | **<0.001** |
| Sugars, syrups, preserves and sweeteners | 8.33 | 9.92 | 12.88 | 20.72 | 0.066 |
| Teas and coffees | 600.74 | 330.56 | 607.29 | 356.07 | 0.432 |
| Other beverages (e.g., fruit juices, carbonated beverages, squash) | 183.57 | 248.57 | 199.41 | 247.81 | 0.318 |
| Alcoholic beverages | 237.50 | 302.35 | 201.00 | 253.52 | **0.002** |
| Fruit | 315.19 | 220.44 | 300.10 | 213.56 | **0.002** |
| Carrots | 31.22 | 24.31 | 27.96 | 25.16 | **<0.001** |
| Other vegetables | 42.52 | 23.97 | 67.72 | 44.88 | **<0.001** |
| Green vegetables | 118.35 | 100.38 | 66.80 | 82.36 | **<0.001** |
| Salad vegetables | 8.22 | 12.07 | 76.42 | 66.77 | **<0.001** |
| Peas, beans and lentils | 27.23 | 55.03 | 27.03 | 65.28 | 0.930 |

P-values derived using 2-samples paired t test. P <0.05 is considered statistically significant. All significant values are indicated in bold text



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| Food Groups | NHANES mean intakes | | Food4Me mean intakes | | p-value* |
|---|---|---|---|---|---|
| | Median (g/day) | IQR (g/day) | Median (g/day) | IQR (g/day) | |
| Breakfast cereals and porridge | 49.79 | 123.00 | 46.32 | 96.11 | 0.211 |
| Bread, rolls, crackers and wraps | 89.69 | 76.39 | 111.75 | 90.64 | 0.056 |
| Potatoes and potato products | 95.82 | 87.71 | 102.11 | 90.95 | 0.889 |
| Rice, pasta, grains and starches | 116.06 | 79.91 | 78.54 | 93.79 | **0.002** |
| Savory dishes | 41.94 | 79.32 | 41.04 | 58.22 | **0.009** |
| Red meat | 35.25 | 50.58 | 33.57 | 50.07 | 0.849 |
| Bacon | 1.64 | 6.86 | 1.64 | 4.57 | **0.002** |
| Meat products | 24.87 | 34.19 | 28.16 | 31.80 | 0.692 |
| Poultry | 50.5 | 53.64 | 43.29 | 44.36 | **<0.001** |
| Fish, fish dishes and fish products | 38.29 | 50.84 | 51.96 | 48.96 | **<0.001** |
| Milk | 189.00 | 263.81 | 194.00 | 253.89 | 0.754 |
| Ice cream, creams and desserts | 19.48 | 23.56 | 14.04 | 15.87 | **<0.001** |
| Yoghurt | 26.79 | 100.97 | 31.25 | 99.27 | 0.200 |
| Cheese | 17.29 | 29.81 | 18.71 | 30.50 | 0.532 |
| Eggs and egg dishes | 40.87 | 53.19 | 42.79 | 47.07 | 0.327 |
| Fats and oils (e.g., butter, low fat spreads, hard cooking fats) | 18.71 | 14.71 | 23.16 | 20.29 | **0.002** |
| Biscuits | 37.55 | 50.74 | 30.99 | 35.62 | 0.037 |
| Cakes, pastries and buns | 19.34 | 36.60 | 15.59 | 32.84 | **<0.001** |
| Confectionary and savory snacks | 16.84 | 20.61 | 17.61 | 22.38 | 0.325 |
| Nuts and seeds, herbs and spices | 1.71 | 4.14 | 1.14 | 3.21 | 0.079 |
| Soups, sauces and miscellaneous foods | 43.79 | 62.17 | 71.43 | 76.95 | **<0.001** |
| Sugars, syrups, preserves and sweeteners | 5.75 | 12.26 | 7.87 | 13.69 | 0.066 |
| Teas and coffees | 503.00 | 409.69 | 494.25 | 414.00 | 0.432 |
| Other beverages (e.g., fruit juices, carbonated beverages, squash) | 103.77 | 173.09 | 134.79 | 170.16 | 0.318 |
| Alcoholic beverages | 143.39 | 260.40 | 140.00 | 174.47 | **0.002** |
| Fruit | 256.93 | 224.50 | 271.57 | 245.23 | **0.002** |
| Carrots | 31.50 | 26.28 | 27.00 | 29.57 | **<0.001** |
| Other vegetables | 43.14 | 38.62 | 64.64 | 46.09 | **<0.001** |
| Green vegetables | 98.70 | 87.80 | 44.89 | 66.52 | **<0.001** |
| Salad vegetables | 1.79 | 12.75 | 61.11 | 89.52 | **<0.001** |
| Peas, beans and lentils | 16.73 | 26.30 | 13.43 | 25.86 | 0.930 |



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Fifteen of the food groups showed statistically significant differences across the FFQs. Significant differences were observed between the fruit and vegetable groups (n=5), snack/treat food groups (Ice cream, creams and desserts group; cakes, pastries and buns group), the rice, pasta, grains and starches group, savoury dishes group, certain meat groups (Bacon; poultry; fish, fish dishes and fish products groups), fats and oils group, soups, sauces and miscellaneous foods group and the alcoholic beverages group. These differences can be attributed to a number of factors:

- Differences between frequency of consumption response categories between FFQs
- Variations between foods listed within specific food groups
- Food items which were listed in 1 FFQ which were not captured within the other

Food groups from Food4Me and NHANES were aggregated into broad food groups as described in Forster et al., [35]. Certain food groups showed significant differences in the mean amounts consumed between the Food4Me and re-entered NHANES data despite the food groups within both FFQs being highly similar (e.g., Breakfast cereals and porridge group). This may be attributed to our mapping of the frequency of consumption categories. Due to the use of different frequency of consumption categories between both FFQs, new harmonised categories were developed which aligned the differing categories (Table 4.5). This may have affected the overall frequency of consumption reported and subsequently lead to differences in the mean food group intakes reported.

Consumption of certain food items which were captured within the Food4Me FFQ had to be excluded in the re-entry process where there was no similar food or food category available in the NHANES FFQ (e.g., Kiwis, Tinned/stewed fruit peaches). Similarly, there were some foods which were included in the NHANES FFQ where there was no corresponding or similar food to map it to within the Food4Me FFQ. Variations between foods across specific food groups was particularly evident for snack, dessert and treat foods where popular snacks and desserts differed between the populations these FFQs were designed for (Europe *vs.* America). These factors may have contributed to the differences observed in mean food group consumption between the two FFQs.



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**Table 4.5 Harmonised frequency of consumption categories**

| Food4Me | NHANES | Mapped |
|---|---|---|
| Never or less than a month | Never | Never |
| 1-3 times a month | 1 time per month or less | 1-3 times/ month |
| Once a week | 2-3 times per month | 1-2 times/ week |
| 2-4 times a week | 1-2 times per week | 3-4 times/ week |
| 5-6 times per week | 3-4 times per week | 5-6 times/ week |
| Once a day | 5-6 times per week | Once daily |
| 2-3 times per day | 1 time per day | 2-3 times/ day |
| 5-6 times per day | 2-3 times per day | 4-5 times/ day |
| >6 times per day | 4-5 times per day | 6+ times daily |
| | 6 or more times per day | |

Conversely, the remaining 16 food groups showed no significant differences in mean consumption between the Food4Me and NHANES FFQ. Groups showing the highest similarities in mean consumption include the potatoes and potato products; red meat; meat products; milk; yoghurt; cheese; and peas, beans and lentils groups. The food items within each of these categories were highly similar across both FFQs, in particular for the dairy food groups.

*Discussion of selected FFQs*

The Food4Me and NHANES FFQs were selected as they represented FFQs which were developed and used within different geographical locations of the world and information from either had not been used in the development of the other FFQ. The selected FFQs likely represented a more challenging mapping process than mapping across some of the other FFQs which contain more similarities due to their use to inform the development of another FFQ or which may use the same or similar composition tables. However, these particular FFQs were selected to really test the feasibility of the developed mapping system.

*Future work and use in FNS-Cloud*

Further work is ongoing to compare the mean nutrient intakes between the different combinations of the FFQs. The full analysis is summarized in Figure 4.10.



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The FFQ mapping system described within this deliverable will be considered for use within DEM03 of the WP5 demonstrators. The development of the mapping system across FFQs and results of the comparison exercise will be included in an academic article which will be submitted for peer-review publication.

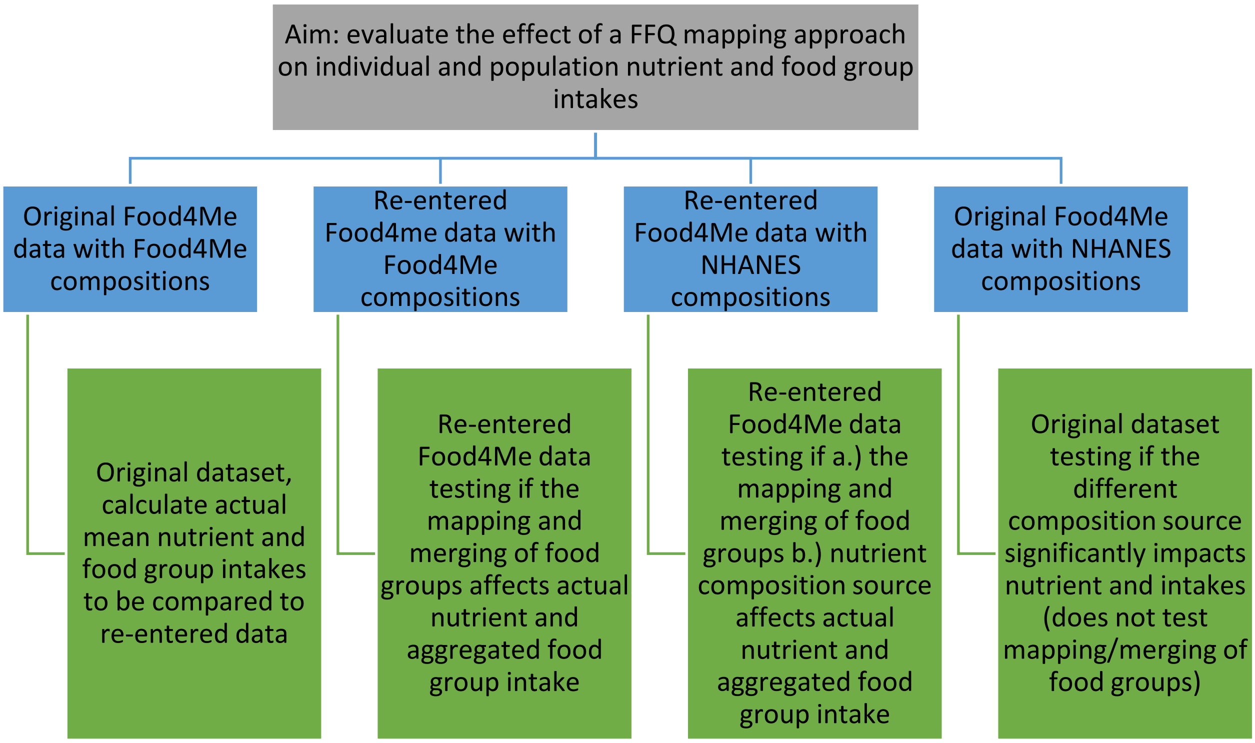


**Figure 4.10. Overview of full analyses to assess the feasibility of developed FFQ mapping system**



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# Appendix A - Input data format

In order to apply the StandFood method and obtain the FoodEx2 codes for any type of data, the input data should be in a predefined standardised format.

## 1. Food composition data

Food composition data (FCD) already comes in a well-structured format to begin with. For applying the StandFood method on FCD the names of the foods need to be available in English. In order to obtain the best possible results, the English food names need to:

- be as descriptive as possible
- contain nouns where possible instead of verbs or adjectives
- be consistent in the use of terminology
    - Example: usage of "&" and "and" – "Iceberger/M and M Cookie Ice-Cream Sandwich" vs. "Half & Half sliced pan (Irish) (unfortified)"
- minimise or avoid the usage of adverbs, prepositions, conjunctions and determiners avoid negations
    - Example: no oil, no fat, no salt, no sugar, no added sugar….
- avoid quantifiers related to food portions or portions per package
    - Example: Sushi (pack of 3)
- avoid using traditional names of foods
    - Example: roasted red pepper relish (ajvar)
        - § if unavoidable include them in brackets after the description in English
- avoid adding unnecessary descriptions
    - Example: "Ribena, all flavours, ready to drink", "Curry Sauce (Take Away)"
- avoid using abbreviations
    - Example: "Chicken Soup (No Veg)", "Chocolate Sauce (Choc/Milk/Butter)", "Turkey and Veg Soup (Carr,Celery,Onion,Leek)"

## 2. Recipe data

### 2.1. Recipe name/title/description



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When mapping the English name of a recipe to the FoodEx2 dataset with StandFood, the same rules as for FCD apply, as the mapping is one to one.

### 2.2. Recipe list of ingredients

If the recipe data is available with the list of ingredients, there should be a uniform standard way of the format in which the list of ingredients comes:

- use a distinct and consistent delimiter for the separate ingredients
  - Example: use ";" as a delimiter as "," might appear in the description/name of one ingredient.
- use a consistent placement and format of percentages
- use consistent placement and format of brackets
- use consistent format of subgroup ingredients

The proposed format for recipe list of ingredients is given in Table 1 and additional information is given bellow the same table.

*Table 1. Format of list of ingredients*

| **Ingredients** |
|---|
| $\text{ingredient}_{1}$ *a%* ($\text{ingredient}_{11}$ *b%* ($\text{ingredient}_{111}$ *c%* ($\text{ingredeint}_{1111}$ *d%;* …; $\text{ingredient}_{111q}$ *e%*); …; $\text{ingredient}_{11p}$ *f%)*; …; $\text{ingredient}_{1m}$ *g%*); …; $\text{ingredient}_{n}$ *h%* ($\text{ingredient}_{n1}$ *i%;* …; $\text{ingredient}_{nr}$ *j%*) |

Where, , is the number of ingredients in the food,  is the number of ingredients in $\text{ingredient}_{1}$,  is the number of ingredients in $\text{ingredient}_{11}$, which is the first ingredient in $\text{ingredient}_{1}$,  is the number of ingredients in $\text{ingredient}_{111}$, which is the first ingredient in $\text{ingredient}_{11}$  is the number of ingredients in ingredient, and  are the percentages of the ingredient before.

Brackets are used to define hierarchy in ingredients. Use only the basic brackets "(" and ")". Brackets shouldn't be used for any other purpose in the ingredient list.



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3. **Branded food data**

For branded foods the same applies as for recipe data. For the name of the food, the name in English is required, the mapping is one to one, and following the rules listed for FCD data is advised, and the usage of the format in Table 1 is required for the ingredient list.

4. **Dietary intake data**

For dietary intake data, the names of the foods are needed, the mapping is one to one, therefore, the same rules listed for FCD data apply.



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# Appendix B

| EPIC | SCG | eNutri | Food4me | NHANES | Japanese |
|---|---|---|---|---|---|
| | | | | *Fruit/Vegetables* | *Fruits* |
| *Fruit* | *Fruit* | *Fruit* | *Fruit* | | |
| Apples | Apples | Apples | Apples | Apples | Apple |
| Pears | Pears | Pears | Pears | Pears | |
| Oranges | Oranges, satsumas or grapefruit | Oranges, satsumas, mandarins | Oranges, satsumas, mandarins | Oranges, tangerines, tangelos | Citrus fruits |
| Grapefruit | | Grapefruit | Grapefruit | Grapefruit | |
| Bananas | Bananas | Bananas | Bananas | Bananas | Banana |
| Grapes | | Grapes | Grapes | Grapes | |
| Melons | All other fruits (grapes, strawberries, melon) | Mango, melon | Mango, melon | Melon | |
| Peaches | Peaches or nectarines | Peaches/plums/apricots /nectarines | Peaches/plums/apricots /nectarines | Peaches, nectarines, plums | |
| Strawberries | | Strawberries, raspberries, cherries | Strawberries, raspberries, cherries | Strawberries | Strawberries |
| | Kiwi fruit | Kiwis | Kiwis | | Kiwi fruit |
| Tinned fruit | Tinned fruit (all types) | Tinned, stewed fruit peaches | Tinned, stewed fruit peaches | | |
| Dried fruit | Dried fruit (e.g., raisins, dates or figs) | Dried fruit e.g., raisins, prunes | Dried fruit e.g. raisins, prunes | Dried fruit | |
| | | | | Pineapple | |
| | Fresh fruit salad | | | | |
| | | | | | Persimmon |
| | | | | | Other fruits |
| *Vegetables* | *Vegetables* | *Vegetables* | *Vegetables* | | |



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| | | | | | |
|---|---|---|---|---|---|
| | | | | | *Green-yellow vegetables* |
| Carrots | Carrots | Carrots | Carrots | Carrots | Carrot |
| | | | | | Tomato juice, vegetable juice |
| Tomatoes | Tomatoes | Tomatoes | Tomatoes | Tomatoes | Tomato |
| | | | | Sweet potatoes/ yams | |
| | | Butternut squash, pumpkin | Butternut squash, pumpkin | Summer squash | Pumpkin |
| Parsnips | | Parsnips, turnips, swedes, celeriac, fennel | Parsnips, turnips, swedes, celeriac, fennel | | |
| Beetroot | | Beetroot | Beetroot | | |
| Cauliflower | Cauliflower, swede or turnips | Cauliflower | Cauliflower | Cauliflower or brussel sprouts | |
| | Brussel sprouts | Brussels sprouts | Brussels sprouts | | |
| Leeks | Leeks or courgettes | Leeks | Leeks | | |
| Garlic | | Garlic | Garlic | Garlic | |
| Sprouts | | Bean sprouts, radish | Bean sprouts, radish | | |
| Onions | Onions | Onions | Onions | Onions | |
| | | | | Raw or cooked greens | |
| | | | | | Green peppers |
| | | | | Cooked greens | |
| Spinach | Spinach or spring greens | Spinach | Spinach | | Spinach |
| | | | | | Greens other than spinach (komatsuna, shungiku, leaves of Japanese radish) |
| Broccoli | Broccoli | Broccoli, spring greens, kale | Broccoli, spring greens, kale | Broccoli | Broccoli |



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| | | | | | |
|---|---|---|---|---|---|
| | | Asparagus, okra | Asparagus, okra | | |
| | Other salad vegetables (lettuce, cucumber etc) | | | | |
| Green salad | | Green salad, lettuce, cucumber, celery, watercress | Green salad, lettuce, cucumber, celery, watercress | Lettuce salads | |
| Beansprouts | | | | | |
| Watercress | | | | | |
| | | | | | *Light-coloured vegetables* |
| Cabbage | Cabbage (all kinds) | Cabbage (red, white, savoy) | Cabbage (red, white, savoy) | Sauerkraut or cabbage | Cabbage, lettuce, cucumber |
| Colelsaw | | Coleslaw, sauerkraut | Coleslaw, sauerkraut | Coleslaw | |
| | | | | | Chinese cabbage |
| | | | | | Eggplant |
| | | | | | Japanese radish (excluding grated radish) |
| | | | | | Grated radish |
| | | | | | Burdock |
| | | | | | Lotus root |
| | | | | | Japanese radish |
| (in soups, sauces, spreads group) | (in soups, sauces, spreads group) | (in soups, sauces, spreads group) | Pickles | Pickles | |
| | | | | (in pulses group) | String beans |
| Peas | Peas or green beans | Fresh/frozen peas/sugar snap peas | Fresh/frozen peas/sugar snap peas | Peas | |
| Green beans | | Green beans, broad beans, runner beans | Green beans, broad beans, runner beans | String beans | |
| Marrow | | Marrow, courgettes, aubergine | Marrow, courgettes, aubergine | | |



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| | | | | | |
|---|---|---|---|---|---|
| Beans | | Baked beans | Baked beans | | |
| Lentils | | Dried lentils, beans, peas, chickpeas | Dried lentils, beans, peas, chickpeas | | |
| | Olives | Olives | Olives | | |
| Peppers | Sweet peppers | Sweet peppers | Sweet peppers | Sweet peppers | |
| | | | | | |
| Sweetcorn | Sweetcorn | Corn (on the cob, sweetcorn) | Corn (on the cob, sweetcorn) | Corn | |
| Avocado | | Avocado | Avocado | | |
| | | | | | *Pulses* |
| Tofu | | Tofu, soya meat, TVP, vegeburger | Tofu, soya meat, TVP, vegeburger | Boiled or chilled tofu (bean curd) | |
| | | | | | Boiled soybeans |
| | | | | | Nattou (fermented soybeans) |
| | | | | | Fried bean curd |
| | | | | | Mapo tofu (bean curd mixed with Chinese meat and chilli sauce) |
| | | | | | Miso (soup) |
| | Mixed vegetable dishes (e.g., stir-fry, curry or bake) | | | Mixed vegetables | |
| | Potato salad | | | | |
| | Coleslaw, or other veg salads in dressing | | | | |
| (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | French fries, home fries, hash browns, tater tots | |
| (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | Potato salad | |



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| | | | | | |
|---|---|---|---|---|---|
| (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | Baked/ boiled/ mashed potatoes | (in potatoes group) |
| | | Sauerkraut stew | Sauerkraut stew | | |
| | | Stuffed cabbage | Stuffed cabbage | | |
| | | | | | *Mushroom* |
| Mushrooms | | Mushrooms | Mushrooms | | Mushrooms (shiitake, shimeji, enokitake) |
| | Tinned vegetables (all kinds) | | | *Seaweed* | |
| | | | | | Hijiki, wakame, kombu (excluding those in miso soup) |
| *Meat and Fish* | *Meats* | *Meat and Fish* | *Meat and Fish* | *Meats, fish and protein* | *Meats* |
| Beef | Beef (roast, grilled, casseroled or fried) | Beef, venison (roast, steak, mince) | Beef, venison (roast, steak, mince) | | |
| | | | | Steak | Beef steak, roast steak |
| | | | | Roast beef/steak in sandwiches | |
| | | | | Beef stew/ pot pie & veg | Other beef dishes (sukiyaki, vegetables fried with beef, potatoes and beef) |
| | Mince or meat sauce (e.g., bolognese) | | Ground beef in mixtures | | |
| | | | | Other minced meat dishes (hamburg steak, meatball, minced meat cutlet) | |
| Burger | Burgers (beef, lamb, chicken or turkey) | Burgers e.g., beef, meatballs | Burgers e.g., beef, meatballs | Roast beef/ pot roast | |



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| | | | | | |
|---|---|---|---|---|---|
| | | | | Beef hamburgers/ cheeseburgers | |
| | | | | Pork/beef spareribs | |
| Sausages | Sausages (pork, beef or frankfurters) | Sausages e.g., pork, jadwurst | Sausages e.g., pork, jadwurst | Sausage | |
| | | | | Hot dogs | |
| Pork | Pork or lamb (roast, grilled, casseroled or fried) | Pork (roast, chops) | Pork (roast, chops) | Pork | Roast pork |
| | | | | | Breaded pork cutlet, pork fillet steak, pork cutlet on a skewer |
| | | | | | Sauteed pork |
| | | | | | Other pork dishes (vegetables fried pork, sweet and sour pork) |
| | | | | | Gyoza (jiaozi) |
| Ham | | | | Baked ham/ ham steak | |
| Bacon | Bacon or gammon | Bacon | Bacon | Bacon | Ham, sausage, bacon |
| Lamb | | Lamb, goat (roast, chops, souvlaki) | Lamb, goat (roast, chops, souvlaki) | | |
| | | | | | |
| Chicken | Chicken or turkey (roast, grilled, casseroled or fried) | Chicken or turkey, grilled, roasted | Chicken or turkey, grilled, roasted | Roast turkey | |
| | | | | Ground chicken/ turkey | |
| | | | | Turkey/ chicken/ ham/ other cold cuts | |
| | | | | Chicken including in salads/mixtures | Other chicken dishes (roast chicken, |



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| | | | | | |
|---|---|---|---|---|---|
| | | | | | chicken boiled with soy sauce) |
| | | Processed chicken or turkey e.g., nuggets, goujons, kiev | Processed chicken or turkey e.g., nuggets, goujons, kiev | Fried chicken/ turkey | Deep-fried chicken |
| | | | | | |
| Corned beef | Cold meats (e.g., ham, corned beef, chicken roll) | Cured meats e.g., corned beef, salami, chorizo | Cured meats e.g., corned beef, salami, chorizo | | |
| | Salami or continental sausage | | | | |
| Savoury pies | Meat or chicken pies, pasties or sausage roll | Savoury pies, meat pie, pasties, sausage rolls | Savoury pies, meat pie, pasties, sausage rolls | | |
| | Haggis or black pudding | | | | |
| | | Sliced cold meats e.g., ham, turkey | Sliced cold meats e.g., ham, turkey | | |
| | | Offal e.g., liver, kidney | Offal e.g., liver, kidney | | |
| Liver | Liver, liver sausage or liver pate | | Liver/ liverwurst | Liver | |
| | | Pate e.g., meat or liver | Pate e.g., meat or liver | | |
| | | Stew and casserole (meat and veg) | Stew and casserole (meat and veg) | | |
| | *Fish* | | | | *Fish and Shellfish* |
| White fish | White fish (e.g., haddock, cod, plaice, scampi) fried or cooked in batter | White fish e.g., cod, haddock, sole | White fish e.g., cod, haddock, sole | | |
| | Grilled, poached or baked white fish | | | | |
| | Smoked white fish | | | | |



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| | | | | | |
|---|---|---|---|---|---|
| Oily fish | Grilled, poached or baked oily fish | | | | |
| | | | | | |
| | | | | | Salmon, trout |
| | | | | | Horse mackerel (including dried) |
| | | | | | Pacific saury, mackerel, sardine, yellowtail |
| | Fried oily fish (e.g., salmon, herring, fresh tuna or mackerel) | Non-smoked oily fish, fresh (mackerel, tuna, sardines, salmon) | Non-smoked oily fish, fresh (mackerel, tuna, sardines, salmon) | Tuna | Canned tuna |
| | Tinned salmon | Non-smoked oily fish, canned (mackerel, tuna, sardines, salmon) | Non-smoked oily fish, canned (mackerel, tuna, sardines, salmon) | | |
| | Tinned tuna | | | | |
| | Smoked oily fish (kipper, mackerel, salmon) | Smoked fish e.g., salmon, mackerel | Smoked fish e.g., salmon, mackerel | Smoked fish/ seafood | |
| | Sardines, pilchards or rollmop herrings | | Fish, not fried, smoked, raw | | |
| | | | | Fried fish/ fish sticks | |
| Shellfish | Prawns, crab etc | Shellfish, crab, prawn | Shellfish, crab, prawn | Other shellfish (asari, shijimi, clam, scallop) | |
| | | | | | Cuttlefish, prawn/shrimp, fried prawn |
| | Mussels, oysters, cockles, scallops | | Raw oysters/ clams | Oyster, fried oyster (in season) | |
| Roe | | Fish roe, caviar, taramasalata | Fish roe, caviar, taramasalata | Cod roe, herring roe | |



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| | | | | | |
|---|---|---|---|---|---|
| | | Sushi | Sushi | Sushi | (in cereals group) |
| Fried fish | | | | | |
| | | | | | Fish with red flesh (tuna, marlin/swordfish, bonito) |
| | | | | | Fish with white flesh (cod, flatfish) |
| | | | | | Eel |
| | | | | | Small fish eaten bone and all (dried sardine, smelt, dried young sardines) |
| | | Fried fish in batter | Fried fish in batter | | |
| Fish fingers | Fish fingers | Fish fingers, fish cakes | Fish fingers, fish cakes | | |
| | Fish cakes, fish pie | Fish dishes e.g., pie, pudding, casserole | Fish dishes e.g., pie, pudding, casserole | | |
| | | | | | Fish paste products (kamaboko, chikuwa, hanpen) |
| (in vegetable group) | (in vegetable group) | (in vegetable group) | (in vegetable group) | Tofu/ soya burgers/ soya meat substitute | (in pulses group) |
| | | | | Dried cooked beans | |
| | | | | Eggs, included in salad | |
| *Cereals* | *Breakfast Cereals* | *Cereals* | *Cereals* | *Breads and cereal* | *Cereals* |
| Porridge | Porridge or Ready Brek | Porridge, readybrek | Porridge, readybrek | Oatmeal or hot breakfast cereal | |
| Cereal | Bran flakes, Sultana bran, All bran etc | Breakfast cereals, wholegrain e.g., branflakes, barley flakes | Breakfast cereals, wholegrain e.g., branflakes, barley flakes | Cold cereal | |



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| | | | | | |
|---|---|---|---|---|---|
| | Shredded wheat, weetabix | | | | |
| | Cornflakes, Rice Krispies, Special K etc | Breakfast cereals, non-wholegrain e.g., cornflakes | Breakfast cereals, non-wholegrain e.g., cornflakes | | |
| | Muesli (all types) | Breakfast cereals e.g., muesli, cruesli | Breakfast cereals e.g., muesli, cruesli | | |
| | Coco pops, frosties, sugar puffs, crunchy nut, nut cornflakes | | | | |
| *Bread and Savoury Biscuits* | *Bread* | *Bread and Savoury Biscuits* | *Bread and Savoury Biscuits* | | |
| | Bread roll or bun | | | Bread/ rolls | Breads |
| White bread | Bread (including toast and sandwiches) | White bread | White bread | | |
| | | White rolls | White rolls | | |
| Brown bread | | Brown bread and seeded bread | Brown bread and seeded bread | | |
| | | Brown and seeded rolls | Brown and seeded rolls | | |
| Wholemeal bread | | Dark wholemeal breads e.g., rye or soda | Dark wholemeal breads e.g., rye or soda | | |
| | | | | Pancakes/ waffles/ french toast | |
| | | | | Bagels/ English Muffin | |
| | | | | Corn bread/ muffins | |
| | Other breads (pitta, naan, soft tortillas) | Tortilla, wraps | Tortilla, wraps | Tortillas/ tacos, corn or flour | |
| Crackers | | Cream crackers, cheese biscuits, rusks | Cream crackers, cheese biscuits, rusks | | |
| Crispbread | | Crispbread e.g., ryvitta | Crispbread e.g., ryvitta | | |



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| | | | | | |
|---|---|---|---|---|---|
| (in sweets and snacks group) | (in chocolates, sweets, nuts and crisps group) | (in sweets and snacks group) | (in sweets and snacks group) | Biscuits | |
| | | | | Stuffing/ dumplings | |
| | Crossaints, butteries or garlic bread | | | | |
| *Potatoes, Rice & Pasta* | *Potatoes, Rice & Pasta* | *Potatoes, Rice & Pasta* | *Potatoes, Rice & Pasta* | *Pasta and rice etc* | *Potatoes* |
| | | | | | Potatoes (white potato, taro, sweet potato) |
| | Mashed potatoes | Potaotes - mashed, instant, roast | Potaotes - mashed, instant, roast | Mashed potatoes | |
| Boiled potatoes | Boiled or baked potatoes | Potatoes - boiled, jacket | Potatoes - boiled, jacket | | |
| Roast potatoes | Roast or fried potatoes | | | | |
| | | | | | Croquettes |
| Potato salad | | | | | |
| | | Potato dishes e.g., salads, dauphinoise | Potato dishes e.g., salads, dauphinoise | | |
| | | Potato or plain dumplings | Potato or plain dumplings | | |
| Chips | Oven chips, potato waffles or croquettes | Chips | Chips | | |
| | Home-cooked chips | | | | |
| | Chips from chip shop or restaurant | | | | |
| | | | | Rice/ other cooked grains | Rice |
| White rice | White rice | White rice | White rice | | |
| Brown rice | Brown rice | Brown rice, buckwheat and barley groats | Brown rice, buckwheat and barley groats | | |
| | | | | | Rice ball |



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| | | | | | |
|---|---|---|---|---|---|
| | | | | | Bowl of rice, topped with chopsuey-like mixture, Japanese pilaf |
| | | | | | Bowl of rice, topped with pork cutlets/chicken and egg/beef |
| | | | | | Pilaf, Chinese fried rice |
| | | | | | Curry and rice, with hashed meat |
| | Pasta (all types or couscous) | | | | |
| White pasta | | White pasta, noodles and other grains e.g., cous cous, polenta | White pasta, noodles and other grains e.g., cous cous, polenta | | |
| Wholemeal pasta | | Wholemeal pasta | Wholemeal pasta | | |
| | | | | Macaroni & Cheese | Spaghetti/ macaroni |
| | | | | Pasta/ macaroni salad | |
| | | | | Other salads/ spaghetti | |
| Lasagne | | Lasagne, mousaka, ravioli and tortelini, filled dumplings | Lasagne, mousaka, ravioli and tortelini, filled dumplings | Lasagne, stuffed shells, stuffed manicotti, ravioli, tortellini | |
| Pizza | | Pizza, calzone | Pizza, calzone | | |
| | | | | | |
| | Noodles (all types) | | | | Japanese noodles (udon, soba, somen, hiyamugi) |
| | | | | | Chinese noodles in soup (lamain) |



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| | | | | | |
|---|---|---|---|---|---|
| | | | | | Chow mein |
| | | Spring rolls | Spring rolls | | |
| | | (in meat and fish group) | (in meat and fish group) | (in meats, fish and protein group) | Sushi |
| *Dairy Products & Fats* | *Dairy Products & Fats* | *Dairy Products & Fats* | *Dairy foods* | *Eggs and dairy products* | |
| | *Milk* | | | | |
| Milk | | | | (in drinks) | Milk |
| | Full fat milk (fresh/dried) | Full-fat/whole milk, buttermilk | Full-fat/whole milk, buttermilk | | |
| | Semi-skimmed milk | Low-fat or semi-skimmed milk | Low-fat or semi-skimmed milk | | |
| | Fully skimmed milk (fresh/dried) | Zero fat or skimmed milk | Zero fat or skimmed milk | | |
| | Condensed/ evaporated milk | | | | |
| | Soy milk | | | | |
| | *Cream and Yoghurt* | | | | |
| | Cream (all types) | | | | |
| Single cream | | Single/sour cream | Single/sour cream | | |
| Double cream | | Double/clotted cream | Double/clotted cream | | |
| | | | | Yoghurt | Yoghurt |
| Full fat yogurt | Full fat yoghurt (greek) | Full-fat/greek yoghurt | Full-fat/greek yoghurt | | |
| Low fat yogurt | Low fat yoghurt (plain, fruit) | Low-fat natural yoghurt, fromage frais | Low-fat natural yoghurt, fromage frais | | |
| | Low calorie yoghurt | | | | |
| | Fromage frais (plain or fruit) | Fruit yoghurt, fruit mousse | Fruit yoghurt, fruit mousse | | |
| | *Cheese* | | | | |
| Cheese | | | | Cheese | Cheese |



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| | | | | | |
|---|---|---|---|---|---|
| | Full hard cheese (e.g., cheddar, gruyere, wensleydale, gouda) | High fat cheeses e.g., stilton, cheddar, brie, gouda | High fat cheeses e.g., stilton, cheddar, brie, gouda | | |
| | Medium fat cheese (e.g., edam, brie, camembert, feta, cheese spreads) | Medium fat cheeses e.g., edam, goats, camembert, feta,emmental | Medium fat cheeses e.g., edam, goats, camembert, feta,emmental | | |
| | Low fat cheese (e.g., low fat cream cheese, low fat hard cheese) | Low fat cheeses - fresh mozzarella, cream cheese, Katiki | Low fat cheeses - fresh mozzarella, cream cheese, Katiki | Cream cheese (in condiments group) | |
| | | Very low fat cheese e.g., cottage cheese, quark | Very low fat cheese e.g., cottage cheese, quark | | |
| | Full fat cream cheese (Philadelphia, Boursin, Danish Blue) | | | | |
| Cottage Cheese | Cottage cheese (all types) | | Cottage cheese | | |
| Dairy dessert | | | | | |
| | (in beverages group) | Milkshakes, fruit smoothies | Milkshakes, fruit smoothies | | |
| | | | | Mayonnaise (in condiments group) | Mayonnaise (in miscellaneous) |
| Salad cream | | Salad cream, mayonnaise | Salad cream, mayonnaise | Sour cream (in condiments group) | |
| Low cal salad cream | | Low fat salad cream, mayonnaise | Low fat salad cream, mayonnaise | | |
| | | | | Salad dressing (in condiments group) | Dressing (in miscellaneous) |
| French dressing | | French dressing, vinaigrette | French dressing, vinaigrette | | |
| Other dressing | | Other salad dressing | Other salad dressing | | |
| | *Eggs* | | | | |



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| | | | | | |
|---|---|---|---|---|---|
| Eggs | Boiled or poached eggs | Egg - boiled, scrambled, omlette etc. | Egg - boiled, scrambled, omlette etc. | Egg, egg dishes (in egg and dairy products group) | |
| | Fried eggs | | | | |
| | Scrambled eggs or omelette | | | | |
| Quiche | | Quiche, savoury pancakes | Quiche, savoury pancakes | | |
| | | | | | |
| | *Spreads and Sugar* | *Fats and Spreads* | *Fats and Spreads* | *Condiments* | *Miscellaneous* |
| | Butter, margarine, fat spread or oil (on bread) | | | | |
| Butter | | Butter | Butter | Butter on breads/pancakes or potatoes/vegetables | Butter for breads |
| Hard margarine | | Block/hard margarine e.g., stork/krona | Block/hard margarine e.g., stork/krona | Margarine on breads/ pancakes or potatoes/ vegetables | Margarine for breads |
| Polyunsaturated margarine | Polyunsaturated marg flora/sunflower/soya | Polyunsaturated marg flora/sunflower/soya | | | |
| Other margarine | | | | | |
| | | Soft marg oilive oil based, bertolli/blue band | Soft marg oilive oil based, bertolli/blue band | | |
| Low fat spread | | Low fat spreads (<60%) | Low fat spreads (<60%) | | |
| Very low fat spread | | | | | |
| | Fat or oil (while cooking) | | Oils for cooking | | |
| | | Olive Oil | Olive Oil | | |
| | Liquid vegetable oil | Other vegetable oils | Other vegetable oils | | |
| | | | | | |



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| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | Salsa | |
| | | | | Gravy | |
| | | | | | Soy sauce |
| | | | | | Worchester sauce |
| | | | | | Sesame |
| | | | | | Deep-fried foods, tempura |
| (in soups, sauces and spreads) | Jam, honey or marmalade | (in soups, sauces and spreads) | (in soups, sauces and spreads) | | |
| (in soups, sauces and spreads) | Peanut butter or chocolate spread | (in soups, sauces and spreads) | (in soups, sauces and spreads) | | |
| | Table sugar | | | | |
| (in soups, sauces and spreads) | Yeast or meat extract (marmite, bovril etc) | (in soups, sauces and spreads) | (in soups, sauces and spreads) | | |
| *Soups, sauces and spreads* | *Savoury foods, Soups and Sauces* | *Soups, sauces and spreads* | *Soups, sauces and spreads* | | |
| | Soup (homemade) | | | | |
| | Soup (tins/ cartons) | | | | |
| | Soup (dried/ instant) | | | | |
| Vegetable soup | | Non-creamy soups e.g.,minestrone, vegetable | Non-creamy soups e.g.,minestrone, vegetable | | |
| | | Creamy soups e.g.,chowder, cream of mushroom | Creamy soups e.g.,chowder, cream of mushroom | | |
| Meat soup | | | | | |
| Sauces | Other sauces (white, cheese curry, sweet & sour) | | | | |



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|---|---|---|---|---|---|
| | | Creamy sauces e.g.,carbonara/cheese | Creamy sauces e.g.,carbonara/cheese | | |
| | Gravy | Dark sauces e.g.,gravy, stir-fry sauces | Dark sauces e.g.,gravy, stir-fry sauces | | |
| | Tomato-based sauces | Tomato sauces e.g.,in Bolognese, on meatballs or pasta | Tomato sauces e.g.,in Bolognese, on meatballs or pasta | | |
| Ketchup | Bottled sauces (e.g.,ketchup) | Tomato ketchup | Tomato ketchup | Ketchup (in condiments group) | |
| Pickles | | Pickles, chutney, satesaus (sate) | Pickles, chutney, satesaus (sate) | Ketchup (in condiments group) | |
| Marmite | | Marmite/bovril | Marmite/bovril | | |
| Jam | | Jam/marmalade/honey | Jam/marmalade/honey | | |
| Peanut butter | | Nut or chocolate spreads e.g.,peanut butter, Nutella | Nut or chocolate spreads e.g.,peanut butter, Nutella | Jam/jelly/honey (in condiments group) | |
| | Pesto | | | Peanut butter/ other nut butter (in condiments group) | Jam, honey for breads (in miscellaneous) |
| | Mayonnaise or salad cream | | Apple sauce | | |
| | Oil & vinegar dressing | | | | |
| | Pickled vegetables or chutney | | | | |
| | Hummus | | | | |
| | | | | | |
| | | | | *Mixed dishes* | |
| (in soups, sauces and spreads group) | (in savoury foods, soups and sauces group) | (in soups, sauces and spreads group) | (in soups, sauces and spreads group) | Chilli | |
| (in potatoes, rice & pasta group) | Pizza | (in potatoes, rice & pasta group) | (in potatoes, rice & pasta group) | Soup | |



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|---|---|---|---|---|---|
| | Quorn products (all types) | | | Pizza | (in meats group) |
| | Soya beans, TVP, tofu or soya meat substitute | | | | |
| | Other beans (kidney, beans, chickpeas) | | | | |
| | Lentils (excluding soup) | | | | |
| | Nut roast, nut burgers or vegetable burgers | | | | |
| (in dairy products and fats group) | Quiche or savoury flan | (in dairy products and fats group) | (in dairy products and fats group) | | |
| | Baked beans | | | | |
| *Sweets and Snacks* | *Chocolates, Sweets, Nuts and Crisps* | *Sweets and Snacks* | *Sweets and Snacks* | | |
| Sweets | Boiled sweets, mints | Sweets, toffees, mints, liquorice | Sweets, toffees, mints, liquorice | | |
| | Fruit gums, pastilles, jellies, chewy sweets | | | | |
| Ice cream | | Ice-cream, choc ices | Ice-cream, choc ices | *Snack foods* | |
| | | Sorbets and jellies | Sorbets and jellies | | |
| Sugar | | Sugar, added to tea, coffee, cereal | Sugar, added to tea, coffee, cereal | | |
| Crisps | Crisps | Crisps or other packet snacks e.g.,wotsits | Crisps or other packet snacks e.g., wotsits | | *Confectioneries* |
| | Reduced fat crisps | | | | |
| | Other savoury snacks (quavers, tortilla chips, popcorn etc) | Tortilla/corn chips | | | |
| | | | | | |
| | | | | Potato chips | |
| | | | | | |



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|---|---|---|---|---|---|
| Nuts | Unsalted nuts | Nuts and seeds e.g., almonds, peanuts, pumpkin seeds | Nuts and seeds e.g., almonds, peanuts, pumpkin seeds | | |
| | Salted nuts (peanuts, cashews etc) | | | | |
| Chocolate | Chocolate sweets, toffees or fudge | Chocolates, single or squares | Chocolates, single or squares | | |
| Chocolate bars | Chocolate (e.g., Mars, Dairy Milk) | Chocolate snack bars eg mars/crunchie | Chocolate snack bars eg mars/crunchie | Popcorn | |
| | | Flapjacks, muesli bars, oatmeal cookies | Flapjacks, muesli bars, oatmeal cookies | Pretzels | |
| | | Snackbarproducts eg frikandel, kroket, bamibal, kaassouflé… | Snackbarproducts eg frikandel, kroket, bamibal, kaassouflé… | Peanuts/walnuts/seeds / other nuts | |
| | | | | | |
| | *Biscuits* | | | | |
| Plain biscuit | Plain (e.g., rich tea, digestive) | Sweet biscuits,chocolate eg digestive, cookies | Sweet biscuits,chocolate eg digestive, cookies | | Peanuts |
| | Sweet (e.g., ginger, custard creams) | Sweet biscuits, plain eg Nice, ginger | Sweet biscuits, plain eg Nice, ginger | Granola bars | |
| Chocolate biscuit | Chocolate coated biscuits | | | | |
| | Shortbread | | | | |
| | Oatcakes | | | | |
| | Cereal bars, flapjacks | | | | |
| (in bread and savoury biscuits group) | Savoury biscuits (crackers, crispbreads) | (in bread and savoury biscuits group) | (in bread and savoury biscuits group) | | Rice cakes |
| | | | | | Rice cakes |
| | *Cakes* | | | | |



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|---|---|---|---|---|---|
| | Plain cakes (sponge, madeira, ginger etc) | Plain cakes eg fruit, sponge, scones, gingerbread, raisinbread | Plain cakes eg fruit, sponge, scones, gingerbread, raisinbread | | |
| | Cakes with jam, cream or icing (victoria sponge, carrot cake etc) | Rich cakes e.g., chocolate, cheesecake | Rich cakes e.g., chocolate, cheesecake | | |
| Home baked cake | | | | | |
| Readymade cake | | | | | |
| Home baked sponge | | | | Crackers | |
| Readymade sponge | | | | *Dessert foods* | |
| | | | | Cake | |
| | Pastries, doughnuts or muffins | Buns, muffins, pastries e.g., croissants, doughnuts | Buns, muffins, pastries e.g., croissants, doughnuts | Cake, sponge cake, Japanese cakes | Crackers, cookies |
| Homebaked buns | | | | | |
| Readymade buns | | | | | |
| | Fruit cakes (all types) | Fruit pies, tarts, crumbles | Fruit pies, tarts, crumbles | | |
| Homebaked fruit pies | | | | | |
| Readymade fruit pies | | | | | |
| | | | | Brownies/cookies | |
| | | Stroopwafle | Stroopwafle | Doughnuts/ sweet rolls/ Danish/ pop tarts | |
| | Pancakes or scones | Waffles, pancakes, crepes | Waffles, pancakes, crepes | | |
| | | Baklava, kantaifi | Baklava, kantaifi | | |
| | *Puddings* | | | Fruit crisp/cobbler/pies | |
| Milk puddings | Milk-based puddings (e.g rice, semolina) | Milk puddings, eg rice, custard, trifle | Milk puddings, eg rice, custard, trifle | | |



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|---|---|---|---|---|---|
| | Sponge puddings (e.g., steamed, syrup, jam) | Sponge puddings | Sponge puddings | | |
| | Custard or other sweet sauces | | | Sweet muffins/ dessert breads | |
| | Wrapped ice creams (cornetto, solero, magnum) | Frozen yoghurt, ices/sorbets, ice/ice-cream bars/sherbet | | | |
| | Other ice creams (all types) | | | | |
| (in sweets and snacks group) | (in sweets and snacks group) | (in sweets and snacks group) | | | |
| | | | Chocolate candy | | |
| | Gateau or cheesecake | | | Pudding/custard | |
| | Fruit-based puddings (e.g., pie, tart, crumble) | | | | |
| | Mousse, trifle, meringue | | | | |
| *Drinks* | *Beverages and Soft Drinks* | *Drinks* | | | |
| | | | *Drinks* | | |
| Instant coffee | Instant coffee (regular) | | | | |
| Decaff coffee | Decaffeinate coffee | | | | |
| | Filter, espresso, or cappuccino coffee | Coffee, milky, latte, cappuccino | | Other candy | |
| | | Coffee, Americano, black | Coffee, milky, latte, cappuccino | | |
| | | Coffee whitener | Coffee, Americano, black | | |
| Tea | Tea (regular) | Tea (black, green, fruit, herbal) | Coffee whitener | | |



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| | | | | | |
|---|---|---|---|---|---|
| | Herbal, fruit or decaffeinated tea | | Tea (black, green, fruit, herbal) | *Beverages* | |
| | | | | Coffee | |
| Cocoa | | | | | |
| | Hot chocolate | Hot chocolate, Ovaltine, Horlicks made with milk | | | |
| Horlicks | Horlicks or Ovaltine | Hot chocolate, Ovaltine, Horlicks, made with water | Hot chocolate, Ovaltine, Horlicks made with milk | | |
| | | | Hot chocolate, Ovaltine, Horlicks, made with water | | |
| | | | | | |
| Fruit juice | Pure fruit juice (orange, apple) | Pure fruit juice e.g., orange | | Hot tea | *Beverages* |
| | | | Pure fruit juice e.g., orange | | Coffee |
| | | | | Iced tea | |
| | | | | | |
| | | | | | |
| | Tomato juice | Tomato and vegetable juices | | | |
| Fruit squash | Blackcurrant squash | Fruit squash/cordial/nectar | Tomato and vegetable juices | | |
| | Other fruit squash | | Fruit squash/cordial/nectar | | |
| Fizzy drinks | Regular fizzy drinks | Fizzy soft drinks eg coca cola/lemonade | | | |
| | | | Fizzy soft drinks e.g., coca cola/lemonade | | |



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|---|---|---|---|---|---|
| Low cal fizzy drinks | Diet fizzy drinks | low calorie/ diet fizzy soft drinks | | | |
| | | Mineral water | low calorie/ diet fizzy soft drinks | Orange juice or grapefruit juice | |
| | | Tap water (not in other drinks) | | Apple juice | |
| | | | | Grape juice | |
| (in dairy group) | (in dairy group) | (in dairy group) | | Other fruit juices | |
| | *Alcoholic Drinks* | | (in dairy group) | Tomato juice, vegetable juice | |
| Wine | | Wine | | | Wine |
| | Red wine | | Wine | | Sake (rice wine) |
| | White wine | | | Soda, regular or diet, with or without caffeine | |
| | | | | Fruit drinks, Hi-C, lemonade | |
| Beer | | Beer, larger, cider | | | Beer |
| | Cider | | Beer, larger, cider | | Shochu (liquor distilled from sweet potatoes, rice, buckwheat) |
| | Low alcohol larger or beer | | | | Whiskey |
| | Dark beer (export, bitter or stout) | | | Meal replacement, energy/ high-protein beverage | Other alcoholic beverages |
| | Light beer (lager or continental beers) | | | Milk, not including milk in cereal | |
| Port | Sherry, port etc | Port, sherry, vermouth, liqueurs | | | |



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|---|---|---|---|---|---|
| Spirits | Spirits or liqueurs | Spirits e.g., Gin, brandy, whiskey, vodka | Port, sherry, vermouth, liqueurs | Wine, wine coolers | |
| | Alcopops (e.g., Bacardi, breezer) | Sweet alcoholic drinks e.g., alchopops, cocktails | Spirits e.g., Gin, brandy, whiskey, vodka | | |
| | | | Sweet alcoholic drinks e.g., alchopops, cocktails | | |
| | | | | Beer | |
| | | | | Liquor, mixed drinks | |



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