Protocol for defining the nutritional adequacy of total diets and foods consumed in EU countries

Deliverable No. 2.2

SUSFANS DELIVERABLES

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Version	Release date	Changed	Status	Distribution
V1	30/09/2016	-		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633692 to the sum of €5M over 2015 to 2019.

SUSFANS DELIVERABLE

Document information

Project name	SUSFANS
Project title:	Metrics, Models and Foresight for European SUStainable Food And Nutrition Security
Project no	633692
Start date:	April 2015
Report:	Protocol for defining the nutritional adequacy of total diets and foods consumed in EU countries
Work package	WP 2
WP title (acronym):	Drivers and data: food consumption and diets
WP leader:	INRA, Stéphan Marette
Period, year:	Month 18; September, 2016
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Participant acronyms:	WU, DTU, SZU, CRA, ANSES
Dissemination level:	**Public**
Version	V1
Release Date	30-09-2016
Planned delivery date:	30-09-2016
Status	Internal review
Distribution	

Dissemination level of this report

Public

ACKNOWLEDGMENT & DISCLAIMER

This research leading to these results has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633692 (SUSFANS). Neither the European Commission nor any person acting on behalf of the Commission is responsible for how the following information is used. The views expressed in this publication are the sole responsibility of the author and do not necessarily reflect the views of the European Commission.

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1. Background and rationale

1.1. Description of work

One of the objectives of the SUSFANS project (WP2, Task 2.2) is to define consumer-based dietary intake data required for modelling healthy diets in four European countries (Denmark, Czech Republic, Italy and France). In this protocol we provide a detailed definition of the nutrition data needed for modelling FNS diets, which involves not only energy intake, but also an adequate intake of specific nutrients relevant for human health. For the assessment of nutritional adequacy of diets, issues need to be discussed like choice of key nutrients, definition of food groups, nutrient contribution of foods, etc. These choices need to be underpinned, e.g. by using dietary reference values (DRVs) from EFSA, (inter)national dietary guidelines, experiences from the EURRECA Network of Excellence and the scientific literature. The protocol developed in this task will be applied to nutritional survey databases in four EU regions in WP7, which is needed for modelling of FNS diets, in particular SHARP diets (WP7). SHARP diets can be described as diets that are environmentally Sustainable, Healthy (nutritionally adequate), Affordable (accessible, yet also supporting the EU agri-food sector), Reliable (stable in their supply) and Preferred (consistent with cultural norms and preferences).

1.2. Deliverables

As described in the SUSFANS project proposal (WP2, D2.2), a protocol for defining the nutritional adequacy of diets, food groups and/or specific foods consumed in different EU regions has to be delivered for use in SHARP modelling (WP7) with an overview of relevant nutritional indicators as input for WP1. This deliverable is due in month 18.

1.3. Related work packages

From the SUSFANS project proposal:

- WP1: Conceptual framework and FNS sustainability metrics
    - Identification of performance metrics for dietary intake
- WP7: Modelling SHARP diets for EU-consumers
    - Task 7.1: Characterisation of the diversity and nutritional adequacy of diets in different EU regions, overall and in relevant population subgroups
- WP9: Long-term modelling of sustainable FNS
    - Linkage of FoodEx2 exposure hierarchy with macro-models

1.4. Rationale

Healthy diets are based on nutrient recommendations that combine minimum and maximum nutrient intakes, and food-based guidelines for some product categories, such as fruits and vegetables, red meat and fish intake. The nutrient-based approach originally has a close link to health, growth and development, e.g., need of adequate intakes of both macronutrients (proteins, carbohydrates, and fats) and micronutrients (vitamins and minerals), whereas the food-based approach is closely linked to food consumption patterns, which are suggested to be strong predictors of health-disease outcomes. Overall, food-based dietary guidelines may be regarded as a holistic approach that provide advice on foods, food groups and dietary patterns to provide the required nutrients to the general public to promote overall health and prevent chronic diseases. Furthermore, food-based dietary guidelines are simple messages on healthy eating, aimed at the general public. They give an indication of what a person should be eating in terms of foods rather than nutrients, and provide a basic framework to use when planning meals or daily menus. In addition, foods are the common denominator for linking diet with sustainability and other diet-related factors, e.g., consumers' preferences, consumers' affordability and accessibility (Figure 1).

Although food-based dietary guidelines cover a wide range of nutrients, in specific subgroups of the population (different age, sex, socioeconomic status and anthropometric factors), some nutrients might become "of concern", i.e. are essential/critical nutrients that are not clearly reflected in the food-based dietary guidelines and/or nutrients relevant for public health.

The aim of the protocol is, therefore, to establish a two-step approach to define nutritional adequacy of diets and food consumption patterns in EU countries. The first step includes a set of food-based dietary guidelines and the second step includes a set of nutrients that are of concern in various regions of the EU. Subsequently, by using this approach, the prevalence of inadequate intakes of a number of foods/food groups and nutrients in the European population can be investigated.

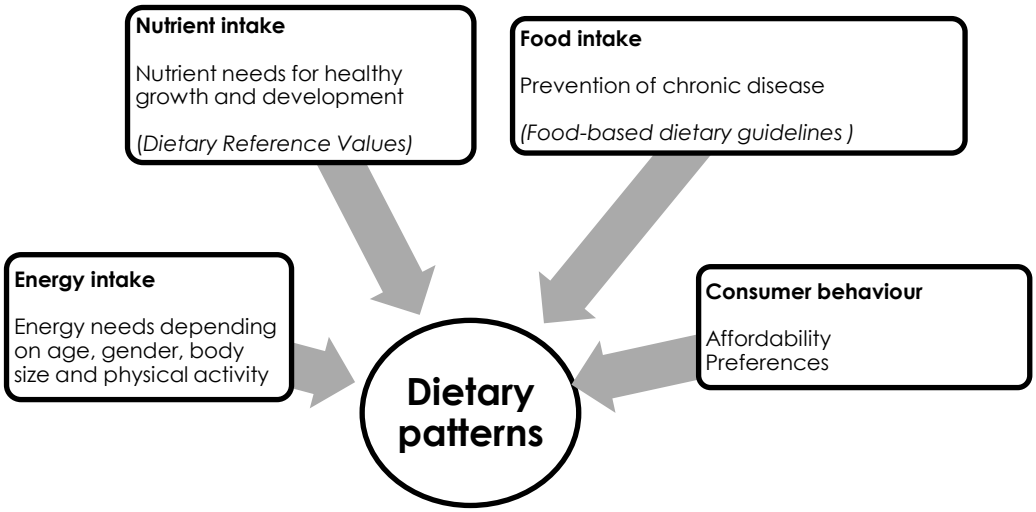

Figure 1 *Determinants of dietary patterns.*

2. Criteria for nutritional adequacy

For the SUSFANS project, criteria for nutritional adequacy for the European population are defined on basis of food-based dietary guidelines, complemented with specific nutrients that are important for human health. More specifically, criteria are based on:

(1) Foods and nutrients that are important for the prevention of major chronic diseases,

(2) Foods and nutrients that are important for growth and development throughout the life cycle,

(3) Nutrients for which intake may become critical when shifting towards a more sustainable diet.

Food safety and allergies are not addressed, as they go beyond the scope of the SUSFANS project.

2.2. Food-based dietary guidelines

Because guidelines are defined at the national level, differences in food-based dietary guidelines exist across Europe. An overview of the different European food-based dietary guidelines is given in Appendix I. Based on this information, we constructed one common set of food-based dietary guidelines to enable comparison of nutritional adequacy between countries that are part of SUSFANS (Denmark, Czech Republic, Italy and France).

To define nutritional adequacy, we set minimum intake levels for foods that are beneficial for health, such as fruits and vegetables, and maximum levels for foods that are not beneficial, such as red meat and salt. For several foods and nutrients, actual dietary intake levels largely deviate from recommended intake levels in European populations. We loosened boundaries for these foods and nutrients (i.e., deviation from guidelines) to be able to examine differences and shifts in nutritional adequacy across countries.

<u>Set of food-based dietary guidelines including cut-offs</u>

Note: The order in which food-based dietary guidelines are presented is in accordance with the food group classification of the FoodEx2.

- Preferably replace white grains (products) by whole grains (products).
- Eat at least *200 grams* of vegetables a day.
- Eat at least one serving of legumes a week; equivalent to *135 grams* per week ≈ *19 grams* a day.
- Eat at least *15 grams* of unsalted nuts or seeds a day.
- Eat at least *200 grams* of fruit a day.
- Eat at most *500 grams* of red and/or processed meat a week; equivalent to *71 grams* a day (prepared weight, not raw weight).
  Preferably choose lean meat, lean cold meat and/or poultry instead of fat and/or red meat.
- Eat at least one serving of fish a week; equivalent to *150 grams* a week ≈ *21 grams* a day.

- Eat at least *300 grams* of dairy products a day; dairy products include milk, yoghurt, fresh cheese, quark, custard, milk puddings, etc., but excluding cheese and butter.
  Preferably choose low-fat dairy instead of full-fat dairy.
- Eat at most *150 grams* of hard cheese a week; equivalent to *21 grams* a day.
- Replace butter, hard margarines and/or hard cooking fats by soft margarines, liquid cooking fats and/or vegetable oils.
- Drink at most *500 millilitres* of sugar-sweetened beverages a week; sugar-sweetened beverages include fruit and vegetable juices, fruit and vegetable nectars and soft drinks, etc.; equivalent to *71 millilitres a* day.
  Preferably replace sugar-sweetened beverages by water.
- Drink at most *one serving* of alcohol a day; equivalent to *10 grams/13 millilitres* ethanol a day.
- Limit the salt intake to 6 *grams a* day.

Considerations

The cut-off points of the food-based dietary guidelines are presented in grams per day with the aim to increase the comparability of food intake between the countries, as serving sizes are country-specific. For some foods, qualitative guidelines are given, such as ‘replace white grains by whole grains’ or ‘preferably choose lean meat’ (see list above). In the main FoodEx2 classification system no differentiation is made between full-fat and low-fat/lean foods. This additional information may be described in so-called 'facets', linked to the FoodEx2 system, which will be further explored.

The difference between whole grain and whole grain products leads to obvious challenges in estimating the intake of this food group, therefore no cut-offs are set for this food group. As an alternative, dietary fibre intake will be used as an indirect indicator for whole grain intake, although dietary fibre also contains other sources of fibre, such as fruit and vegetable fibre. For descriptive purposes, we will present the intake of whole grain products using a more in-depth grouping: intake of bread and similar products, intake of pasta, dough and similar products, and intake of breakfast cereals. This will give a crude estimate of the total intake of whole grain products.

Certain foods and beverages that are not included in this set of food-based dietary guidelines will be considered because they are important for describing dietary patterns in populations. These include eggs, coffee, tea and starchy foods like potatoes.

Detailed information on the food-based dietary guidelines is given in **Appendix II.** This appendix includes a summary of the national-specific food-based dietary guidelines of Denmark, Czech Republic, Italy, France and the Netherlands, and background information with literature references to support the set of food-based dietary guidelines for the SUSFANS project. The set of food-based dietary guidelines will be used by WP7, Task 7.1

2.3. Nutrient recommendations

Nutrient-based recommendations are included for nutrients of concern, i.e. essential/critical nutrients relevant from a public health's perspective due to the shift from an animal-based dietary pattern towards a more plant-based dietary pattern and/or nutrients that are not clearly reflected in the food-based dietary guidelines.

From both a health and a sustainability perspective, dietary guidelines point to diets with a higher content of plant-based products and a lower content of animal-based products. However, shifting towards these plant-based diets might raise concerns about specific nutrients that are largely-derived from animal-based products, such as, protein type and essential amino acids, essential omega-3 polyunsaturated fatty-acids, including alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), iron, zinc, iodine, calcium, vitamin D, and vitamin B12.

In addition, there are concerns about some other nutrients according to the nutritional experts in the four countries. These are: dietary fibre, added sugars, saturated fatty acids, folate, and vitamin B6. In this context, added sugars refer to sucrose, fructose, glucose, starch hydrolysates (glucose syrup, high-fructose syrup) and other isolated sugar preparations used as such or added during food preparation and manufacturing (as mentioned in the EFSA definition), and thus not referring to monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer, and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates (as mentioned in the WHO definition on free sugars).

Nutrient intake calculations might be hampered by reliability of the nutrient estimations in the national food composition tables. Possible limitations in the food composition table as mentioned by the four countries:

Denmark: Uncertainties/unavailability in the estimates of fatty acid composition.

Czech Republic: Unavailability of animal and plant protein, trans fatty acids, fluoride, vitamins B3 (niacin), B6, B12 (cobalamin), pantothenic acid, and biotin. Also, the national food composition table of Czech Republic does not have (updated) nutrient estimates available for copper, selenium, zinc, iodine, manganese, and molybdenum. However concentration values measured in the national Total Diet Study (2014 – 2015) were used instead to calculate nutrient intake. The intake of added sugar was calculated by selecting appropriate foods according to the EFSA definition and then summing the sugar content obtained from the food composition table of these food items. Sodium intake presents the total dietary sodium from foods and composite foods including recipes.

Italy: Unavailability of estimates on added sugar

France: Unavailability of estimates on added sugar

In summary, we selected the following nutrients for inclusion in the set of nutrients of concern: saturated fatty acids, dietary fibre, iron, zinc, iodine, calcium, folic acid, vitamin B6 and B12, and vitamin D. This selection was based on three criteria: (1) essential nutrients that are not clearly reflected in the food-based dietary guidelines; (2) nutrients that are commonly under- or over-consumed in European countries, hence public health relevant nutrients; and (3) nutrients for which intake may become critical when shifting from an animal-based dietary pattern towards a more plant-based dietary pattern.

Dietary Reference Values (DRVs) for nutrients, established by the European Food Safety Authority (EFSA), will be used to assess the adequacy of nutrient intake at the population level (overview in **Appendix III**).The DRVs indicate the amount of an individual nutrient that people require for good health, by age and sex. We used the Average Requirement (AR); or the Adequate Intake (AI) if AR could not be set. The AR is the level of nutrient intake estimated to meet the physiological requirement or metabolic demand in half of the healthy individuals in a particular life stage and sex group, given that the supply of energy and other nutrients is adequate. The AI is the average daily level of intake based on observed or experimentally determined approximations or estimates of nutrient intake by a group of apparently healthy people that is assumed to be adequate. DRVs for energy-bearing nutrients (fat, protein and carbohydrates) are expressed in energy percentages using an intake range (ADMR; Acceptable Macronutrient Distribution Range), and for other nutrients in absolute amounts using sex- and age-specific cut-offs. When no AR or AI was defined by EFSA for the nutrient under study (specific fatty acids, sodium, vitamin B1 and B2), we used the Estimated Average Requirement (EAR) defined by the Institute of Medicine (IOM) for setting cut-off values.

3. EFSA FoodEx2 classification system and linkages

3.1. FoodEx2 classification system

We make use of the FoodEx2 Exposure hierarchy from the European Food Safety Authority (EFSA) to consistently classify the food consumption data obtained from national food consumption surveys[(1)]. This hierarchy consists of 4,311 food items structured in six levels with 21 groups at the top level, and is designed for exposure calculations of foods and food groups, hereby facilitating cross-country comparisons for the intake of foods and/or food groups. Of the European Union, 22 member states have classified all the foods and beverages present in their national food consumption databases according to the FoodEx2 Exposure hierarchy[(2)]. However, methodological differences exist in the food consumption data related to the national dietary survey/assessment method, hence the accuracy of reporting the foods and beverages consumed. In line with this, the level of food disaggregation (mixed dishes in particular) into ingredients is of major concern when aiming at cross-country comparisons. In this study, disaggregation of foods into ingredients was only considered as necessary for foods prepared at home provided that foods as itself is not included in the FoodEx2 – Exposure Hierarchy, but its ingredients are.

Another important issue to emphasise is the differences in the amount reported; which is 'as purchased or as raw (as edible portions)' in Denmark, Czech Republic and Italy, and 'as consumed' in France. Of interest is assessing the nutritional adequacy of the diet by using foods 'as consumed', hence the weight for the edible portion of foods and/or the weight after food preparation for prepared food products. Therefore, the amount where reported 'as purchased or as raw (as edible portion)' has to decrease to account for edible proportion of food items (e.g. factor for edible portion for fruit and vegetables) and weight loss during cooking (e.g. slink factor for vegetables, meat and fish), and has to increase to account for hydration when cooked (e.g. swell factor for rice and pasta) by using product-specific conversion factors derived from recipes and food preparation methods. In short, this recalculation of foods 'as purchased or as raw (as edible portion)' to 'as consumed' makes it possible to accurately assess the nutritional adequacy of the diet, and to validly compare food intake cross-country.

3.2. FoodEx2 linkage with the common set of food-based dietary guidelines

The foods and/or food groups included in the common set of food-based dietary guidelines is linked to representative foods or food groups included in the FoodEx2 Exposure hierarchy. This allows for an evaluation of the adherence to the food-based dietary guidelines for each country at the population level. **Appendix IV** provides an overview of food items from FoodEx2 that are included in the different food groups as presented in the common set of food-based dietary guidelines (Table IV.1), as well as extended background information on the selection of the FoodEx2-codes.

Note 1: Reported amounts should be 'as consumed', not 'as purchases or as raw'.
Note 2: The assessment of nutritional adequacy is based on the aggregation of food items into the food groups, thus in general referring to the upper-levels of the FoodEx2. However, the design of the SHARP diet using diet modelling techniques is based on the individual food items, thus referring to the lower levels of the FoodEx2.

3.3. FoodEx2 linkage with H-indicators

This activity relates to WP7, Task 7.1: To collate individual-level food and nutrient intake data from national surveillance studies representing the EU diversity in food patterns.

The H-indicator (Health) in SHARP modelling will be operationalised by assessing the nutritional adequacy of population diets, based on individual level data. Food composition tables are important for deriving nutrient intakes in the four countries of interest. Whenever possible, country-specific food composition tables are used because they reflect more accurately the nutrient composition of typical foods consumed by that population.

3.4. FoodEx2 linkage with S-indicators

This activity relates to WP7, Task 7.3: To identify databases with public data or company data on environmental impact indicators (e.g. CO_2 emission) …

The S-indicator (environmental Sustainability) in SHARP modelling still needs to be operationalised, using input from other WPs in SUSFANS. One of the aspects that needs to be addressed is whether sustainability indicators are available for foods as consumed, or for commodities (primary agricultural products), and how that links to FoodEx2 classification.

3.5. FoodEx2 linkage with ARP-indicators

This activity relates to WP7, Task 7.3: To identify databases with public data or company data on […] economic indicators (e.g. product prices) and consumer preferences.

The ARP-indicator (Affordability Reliability, Preferences) in SHARP modelling still needs to be operationalised, using input from other WPs and private partners in SUSFANS. There is a need to identify databases on dietary affordability (product prices, price elasticity), reliability and preferences. Dietary preferences may (partly) be derived from actual consumption data.

3.6. FoodEx2 linkage with other models that use FAO commodity classifications

This activity relates to WP9, Task 9.1: Development of a work plan for operationalising the assessment framework in the SUSFANS toolbox, and to WP9, Task 9.5: T9.5: Creation of the SUSFANS Toolbox for assessing EU SFNS.

In this work plan, it should be specified how macro models (e.g. MAGNET, WP9) and micro models (SHARP, WP7) can 'talk' to one another. To achieve this, 'food products as consumed' must be translated into 'primary commodities', as outlined below. A primary commodity is considered as an end product from primary agricultural production, hereby excluding the later stages of processing the ingredients into different food products as consumed.

1. Defining the primary agricultural products in the food products as consumed
   i. Identical food products are directly converted into primary agricultural products.
   ii. Composite food products (whether processed or not) are broken down into its ingredients, expressed in primary agricultural products, by using recipes from the FoodEx2 classification system (if available) and otherwise using recipes from country-specific cookbooks (on the assumption to apply home-made recipes to industrial products). (Disaggregation into primary agricultural products)
   iii. After identifying the ingredients of the composite food products, it is important to identify the processing type per ingredient because the processing type is closely related to the quantity of the primal agricultural products. (Processing information of primary agricultural products)

2. Defining the quantity of the primary agricultural products
   i. For identical food products, the quantity of the primary agricultural product is 100% of the food products as consumed, if not processed.
   ii. For composite food products (whether processed or not), the quantity of the ingredients represents the quantity of the primary agricultural products of that mixed or composite food product.
   iii. When considering processed food products (whether composite or not), the quantity of primary agricultural products is back-transformed to the weight of the raw primary agricultural product using conversion factors. Therefore, the weight of the raw primary agricultural product might have to increase to account for edible proportion of food items (e.g. not bones from meat, peelings from potatoes) and weight losses during processing/cooking, in retail and preparation (e.g. for vegetables, meat), and to decrease to account for any weight increase through hydration when cooked (e.g. for rice and pasta). (Conversion factors correction for 'edible portion', 'losses', 'shrinkage', and 'swelling', if available)

4. Methodological / data considerations

4.1. Dietary assessment methods: description and standardisation

Table 1 Surveys included in SUSFANS

Country	Survey	Year	Population (age and sex)	Sample size (Response%)	Dietary method	Number of week- and weekend-days	Seasonality	Number of food items reported by the survey
Denmark	The Danish National Survey on Diet and Physical Activity– National Food Institute, Technical University of Denmark (DTU)	2005-2008	M + F 4 – 75 years	2,700 (53%)	7-day diet record on consecutive days	70% week days 30% weekend days	…spring …summer …autumn …winter	…
Czech Republic	Czech National Food Consumption Survey (SISP04) – National Institute of Public Health	2003-2004	M + F 4 – 90 years	2,590 (54%)	2 x 24-hour recall on non-consecutive days	74% week days 26% weekend days	34% spring 22% summer 15% autumn 29% winter	459
Italy	Italian National Food Consumption Survey - INRAN-SCAI - National institute for Research on Food and Nutrition	2005	M + F 0 – 98 years	3,323 (33%)	3-day diet record on consecutive days	78% week days 22% weekend days	26% spring 24% summer 25% autumn 25% winter	1114
France	Individual and National Study on Food Consumption 2 (INCA-2) - Agence Française de Sécurité Sanitaires des Aliments (AFSSA)	2006-2007	M + F 3 – 79 years	4,079 (60%)	7-day diet record on consecutive days	72% week days 28% weekend days	…spring …summer …autumn …winter	…

Description:

The dietary data are collected at the individual level by means of replicates of 24-hour dietary recalls (Czech Republic) or diet records (Denmark, Italy and France), and are representative at the national level, providing information on the distribution of food consumption in well-defined groups and hereby enabling an estimation of usual intake for the assessment of nutritional adequacy at population level. Furthermore, all country-specific food consumption survey data are provided at the most disaggregated level and linked to the 'Exposure Hierarchy' of the FoodEx2 classification system developed by EFSA. However, differences exist with respect to a number of factors affecting the level of detail and accuracy of the collected dietary data, for example survey year, age distribution of the population, dietary assessment methods, number of days per subject, number of food items reported, etc.

Standardisation:

Standardisation of the dietary assessment methods is required to obtain an estimate of food intake that is comparable across the countries. Therefore, the number of days to be included should preferably be the same among the different countries, because the percentage of non-consumers is highly dependent on this. The lowest number of days recorded is two independent days in Czech Republic (two replicates of 24-hour recall on non-consecutive days), thus Denmark, Italy and France have to select two random independent days from their dietary surveys as well. Italy selects day 1 and day 3 from their 3-day diet record, while Denmark and France uses random selecting techniques to select two random days from their 7-day diet record. A full description on how these random selecting techniques were applied is given in Appendix V.

Misreporting:

In the SUSFANS project under- and over-reporters will not be excluded, but the prevalence of under- and over-reporters for the total population and for relevant population subgroups will be reported. The under- and over-reporters will be identified by the Goldberg's cut-off values with revised factors of Black[(3)]. Extended background on the equations to derive these confidence limits is given in Appendix VI.

Supplement usage:

In the SUSFANS project, we are interested in nutrient intake from foods only, thus excluding dietary supplement use. The prevalence of supplement use should be reported for the total population and for relevant population subgroups to find out whether there are differences in dietary supplement use across Europe. The prevalence of nutrient adequacy in populations could be influenced by dietary supplement use. In countries with prevalent use, supplement intake might have contributed to increased nutrient intakes, hence improved adequacy levels.

4.2. Assessment of nutritional adequacy

This activity relates to WP7, Task 7.1: To collate individual-level food and nutrient intake data from national surveillance studies representing the EU diversity in food patterns.

To assess the prevalence of (in)adequate intakes in a population, it is essential to estimate the usual dietary intake of the individuals comprising the given population, as this represents an individuals' long-term average daily intake of foods and nutrients. Usual intake can be measured by a quantitative or semi-quantitative FFQ or by daily survey methods, e.g. diet record and 24-hour recall, when administered on repeated occasions and/or adjusted for intra-individual variability in data derived from two or more records/24-hour recalls using statistical modelling techniques. The numbers of days and/or the additional adjustment are important considerations to avoid biased estimates resulting from intra-individual variation in dietary intake, which is particularly a concern for dietary factors that are consumed episodically rather than daily. However, to increase the comparability between the countries, the same number of days for each country, that is two days independent of each other will be selected as described in the previous paragraph.

The objective of the present study is to assess the nutritional adequacy of EU diets, characterised by four countries assumed to be representative for the different EU regions. For this purpose, the established common set of dietary guidelines will be used, in which both the intake of food groups and nutrients of concerns are considered.

Presenting the data (based on an average of two days per person):

- Number of subjects
- Mean ± SD, in the overall group and in consumers only
- Median (25th – 75th percentile), in the overall group and in consumers only
- Percentage of consumers for specific food
- For foods: percentages of the population with adequate intake, i.e. above the cut-off for foods to encourage and below the cut-off for foods to limit
- For nutrients: percentage of the population with adequate intake, i.e. above the AR (or AI) for nutrients to encourage, and within the AMDR for macronutrients.

Dietary data to be provided in tables, by four European partners:

- Mean daily intakes of the food groups from the common set of food-based dietary guidelines in different EU countries in amounts per day, the percentage of consumers and the percentage of the population having an adequate intake (with supplementary tables for relevant population subgroups)
- Mean daily intakes of selected nutrients of concern in amounts per day and the percentage of the population having an adequate intake based on DRVs as set by EFSA(with supplementary tables for relevant population subgroups)

Assessment of nutritional adequacy using food-based dietary guidelines

This is done by calculating the percentage of the population that have an intake above the cut-off value for minimum intake level, and below the cut-off value for maximum intake levels. Standardisation of this percentage by age, energy intake and body mass index (BMI) will be considered.

Assessment of nutritional adequacy using nutrient-based dietary guidelines

This is done by calculating the percentage of the population with an intake above the AR (or AI, if not available) for nutrients to encourage, and within the AMDR for macronutrients based on raw dietary data. Alternatively, statistical methods may be applied for calculating nutrient adequacy at the population level using the arithmetic mean and standard deviation of intake.

- (E)AR cut-point approach, a shortcut to the probability approach

  The percentage of the population with probable inadequate intakes is estimated by taking the percentage of the population with a usual intake that is lower than the (E)AR. When no (E)AR can be set, groups with mean intakes at or above the AI level can be assumed to have a low prevalence of inadequate intakes for that nutrient. Both for the (E)AR and the AI, sex-and age-specific cut-off values are used.

  - Information needed to apply this method:
    - (E)AR or AI
    - Distribution of usual intake
  - Model assumptions to apply this method:
    - Intake and requirement are independent
    - Requirement distribution is symmetrical around the (E)AR
    - Variance in intake is larger than the variance in requirement
    - True prevalence of inadequacy in the population is no smaller than 8 to 10 percent or no larger than 90 to 92 percent.
- Probabilistic methods which take into account both the intake and requirement variability might be a useful alternative for the (E)AR cut-point method, and give a better estimation of the real prevalence of inadequacy, e.g. in case of a skewed distribution (Iron).

4.3. Population subgroups

The nutritional adequacy of the diet in different EU regions will be characterised in the overall country-specific population and in relevant population subgroups by age, sex, socioeconomic status and BMI.

Population subgroup by age:

Age population subgroups range from infants to adults aged 75 years or older. However, the characterisation of nutritional adequacy should be focussed on the general population of adults only,

since the common set of dietary guidelines with the set cut-offs values are based on this population subgroup. However, it might be interesting to look into the nutritional adequacy of other age subgroups as well, when extrapolating the cut-off values of the dietary guidelines to those age subgroups.

- Infants 0 – 11 months
- Toddlers 12 – 35 months
- Other children 36 months – 9 years
- Adolescents 10 – 17 years
- Adults 18 – 64 years
- Elderly 65 – 74 years
- Very elderly ≥ 75 years

Table 1.1 Population subgroup by age

	Denmark (n=1,739)	Czech Republic (n=2,590)	Italy (n=3,323)	France (n=4,079)
Infants (n) 0 – 11 months	/	0	16	0
Toddlers (n) 12 – 35 months	/	0	36	0
Other children (n) 36 mo – 9 years	298 (4-9y)	413	193	482
Adolescents (n) 10 – 17 years	377	308	247	973
Adults (n) * 18 – 64 years	1739	1666	2313	2276
Elderly (n) 65 – 74 years	274	144	290	264
Very elderly (n) ≥ 75 years	12	59	228	84

- * For example, the age range of 18 – 64 years includes all subjects that are at or above the age of 18 years old until the age of 64 years, thus excluding the subjects that are at the age of 65 years. Subjects at the age of 65 years are included in the next age range.

Population subgroup by sex:

The common set of dietary guidelines is based on the general population of adults; however the cut-off values, especially for nutrient intake, might differ for sex. Therefore, men and women will also be examined separately.

Table 1.2 Population subgroup by sex

	Denmark	Czech Republic	Italy	France
Adolescents (n) 10 – 17 years				
Male	162	157	108	449
Female	215	151	139	524
Adults (n) 18 – 64 years				
Male	777	793	1068	1936
Female	962	873	1245	1340
Elderly (n) 65 – 74 years				
Male	150	59	133	111
Female	124	85	157	153
Very elderly (n) ≥ 75 years				
Male	5	21	69	40
Female	7	38	159	44

Population subgroup by socioeconomic status:

Lower socioeconomic status, i.e. lower levels of education and income, is associated with less healthy dietary habits. Particularly, subjects with a low socioeconomic status are more likely to have higher intakes of energy-dense foods, white bread, starchy foods and processed meat, and lower intakes of fresh fruit and vegetables, whole grains, fish and meat. Their diet is, thus, likely to be low in fibre, vitamins B1, B2, B3, B6, B12 and C, folate, calcium, magnesium, iron, potassium and zinc, but high in energy and sodium. This is partly attributable to their priorities in food choice motives that are mainly driven by price and familiarity and less driven by health considerations. In the present study, socioeconomic status is determined by their highest education level completed:

- Low primary or lower secondary degree
- Intermediate higher secondary degree
- High higher education or university degree or post-university degree

Table 1.3 Population subgroup by SES [1]

	Denmark	Czech Republic	Italy[3]	France
Adolescents (n) 10 – 17 years [2]				
Low SES		not available	not available	not available
Intermediate SES				
High SES		not available	not available	not available
Adults (n) 18 – 64 years				
Low SES	916[4]	345	692	1039
Intermediate SES				
High SES	671	1321	1492	1232
Elderly (n) 65 – 74 years				
Low SES	194[5]	69	189	172
Intermediate SES				
High SES	77	75	85	91
Very elderly (n) ≥ 75 years				
Low SES	7	31	4	62
Intermediate SES				
High SES	5	28	-	22

[1] Socioeconomic status is determined by education level (low SES includes the subjects with a primary and/or lower secondary degree completed; high SES includes the subjects with a higher secondary degree, higher education and/or university degree completed).
[2] If socioeconomic status is determined for this population subgroup, then please specify how this is determined.
[3] Data available only for individuals >15 years old; missing data: Adults n=129; Elderly n= 16; very elderly n=224.
[4] 1 Missing value; Not included (attending school and finished high school) = 151
[5] Not included (attending school and finished high school) = 3

Population subgroup by BMI:

Previous studies have investigated lifestyle habits and dietary patterns in association with weight status and/or body mass index, showing inconsistent results. However, it is generally acknowledged that consuming a healthy diet, characterised by high intake of nutrient-dense foods, is associated with lower total energy intakes and body mass index. BMI, calculated as body weight (kg) divided by height (m) squared, is classified as follows:

- Low and normal < 25 kg/m^2
- High (i.e., overweight) ≥ 25 kg/m^2

Table 1.4 Population subgroup by BMI [1]

	Denmark	Czech Republic	Italy	France
Adults (n) 18 – 64 years				
Low and normal BMI	970[2]	802	1484	1383[5]
High BMI	740	864	828	867
Elderly (n) 65 – 74 years				
Low and normal BMI	231	41	121	106
High BMI	153[3]	103	169	158
Very elderly (n) ≥ 75 years				
Low and normal BMI	6	26	107	30[6]
High BMI	5[4]	33	121	51

[1] The Body Mass Index is calculated as body weight divided by height squared (normal BMI includes all the subjects with a BMI lower than 25 (< 25 kg/m^2); high BMI includes all the subject with a BMI of 25 or higher (≥ 25 kg/m^2).
[2] 29 missing values [3] 5 missing values [4] 1 missing value [5] 26 missing values [6] 3 missing values

4.4. Access to the dietary data

In the EFSA data warehouse, except for Denmark, the food consumption data are still classified according to the FoodEx1 classification system. Therefore, we appeal to the countries directly for their national food consumption data classified according to the FoodEx2 classification system. The following steps are/will be taken:

- Each country links individual food consumption survey data to the FoodEx2 classification system in order to calculate the intake of the food groups included in the common set of food-based dietary guidelines.
- Each country links food consumption survey data to the national food consumption database in order to calculate nutrient intakes.
- Each country is willing to share dietary data for the purpose of this SUSFANS project.
    - Each country calculates the required dietary intake estimates in order to assess the nutritional adequacy of EU diets.

5. SUSFANS metrics of WP1

This activity links to WP1, Task 1.1: Developing a conceptual framework for the assessment of sustainable FNS in EU.

5.1. Policy goal

Balanced and sufficient diet for EU citizens.

5.2. Performance metrics

% of the population that have a normal weight vs overweigh vs obese (energy balance)
% of the population that fulfil food-based dietary guidelines
% of the population that fulfil nutrient requirements (DRVs)

5.3. Aggregate indicators

Compliance with food-based dietary guidelines – use a summary score (list of 5 – 6 key foods to focus at e.g. fruit and vegetables, whole grains, fish, limited red and processed meat)
(Relevant summary diet scores available, e.g. DASH score, Alternative Healthy Eating Index...)
Compliance with DRVs – use a summary score (e.g. NRF9.3, nutrient density scores...)

Note: The aggregated indicators should integrate foods, nutrients and energy balance, and should include the intake distribution in the population according to SES/education level.

5.4. Derived variables

Compliance with individual food-based dietary guidelines
Compliance with DRVs

5.5. Individual variables

Dietary intake of foods based on common set of food-based dietary guidelines (that are linked to FoodEx2); dietary intake data available for the four EU countries (including food and nutrient intake)

6. References

1. European Food Safety Authority (2015) The food classification and description system FoodEx2 (revision 2). *EFSA supporting publication 2015* **En-804**, 90.
2. EFSA (Eurepean Food Safety Authority) (2011) Use of the EFSA Comprehensive European Food Consumption Database in Exposure Assessment. *EFSA Journal 2011* **9**, 2097.
3. Black AE (2000) Critical evaluation of energy intake using the Goldberg cut-off for energy intake: basal metabolic rate. A practical guide to its calculation, use and limitations. *International Journal of Obesity & Related Metabolic Disorders* **24**.

7. Appendixes

I. Food-based dietary guidelines across Europe

II. Set of food based dietary guidelines

III. Dietary Reference Values (DRVs) by the European Food Safety Authority (EFSA)

IV. Linkage with FoodEx2

V. Reducing consecutive 7-day diet record to two random non-consecutive days

VI. Equations for the identification of misreporting

APPENDIX I: Food-based dietary guidelines across Europe

Country	Food-based dietary guidelines	Year
Albania	Recommendations on healthy nutrition in Albania (Albanian: *Rekomandime për një ushqyerje të shëndetshme në Shqipëri*)	2008
Austria	The Austrian food pyramid – 7 steps to health (German: *Die österreichische Ernährungspyramide – 7 Stufen zur Gesundheit*)	2010
Belgium	De Actieve voedingsdriehoek – VIGeZ Vlaams instituut voor Gezondheidspromotie en Ziektepreventie (Vlaanderen)	2011
Bosnia and Herzegovina	Guide on nutrition for the adult population (Bosnian: Vodič o ishrani za odraslu populaciju)	2004
Bulgaria	Food Based Dietary Guidelines for Adults in Bulgaria 2006 MH, NCPHP Authors: S. Petrova, K. Angelova, D. Bajkova et al.	2006
Croatia	Dietary guidelines (Croatian: *Prehrambene smjernice*).	2002
Cyprus	National nutrition and exercise guidelines (Greek: *εθνικές οδηγίες διατροφής και άσκησης*).	2007
Czech Republic	Nutrition recommendations for Czech Republic (Czech: Výživová doporučení pro obyvatelstvo České republiky)	2012
Denmark	The official dietary guidelines (Danish: *De officielle kostråd*).	2013
Estonia	Estonian food and nutrition recommendations (Estonian: *Eesti toitumis-ja toidusoovitused*).	2012
Finland	Finnish nutrition recommendations 2014 (Finnish: *Terveyttä ruoasta. Suomalaiset ravitsemussuositukset 2014*).	2014
France	La Santé vient en mangeant Le guide alimentaire pour tous	2002
Georgia	Healthy eating – the main key to health (Georgian: *jansaRi kveba – janmrTelobis mTavari gasaRebi*).	2005

Germany	Ten guidelines for wholesome eating and drinking from the German Nutrition Society (German: *Vollwertig essen und trinken nach den 10 Regeln der DGE*).	2013
Greece	Dietary guidelines for adults in Greece – Ministry of Health and Welfare Supreme Scientific Health Council	2014
Hungary	Dietary guidelines for the adult population in Hungary (Hungarian: *Táplálkozási ajánlások a magyarországi*).	2004
Iceland	Dietary and nutrient guidelines (Icelandic: *Ráðleggingar um mataræði og næringarefni*).	2014
Ireland	Healthy Eating Guidelines and the Food Pyramid (2015) – Department of Health and Health Service Executive	2015
Israel	The Israeli food pyramid (Hebrew: *פירמידת המזון* הישראלי).	2008
Italy	Guidelines for healthy Italian food habits, 2003 (Italian: *Linee guida per una sana alimentazione italiana. Revisione 2003*).	2003
	Reference level for nutrient and energy for the Italian population IV Review: Quantification of standard portion sizes (Italian: Livelli di Assunzione di Referimento di Nutrienti ed energia IV Revisione: Standard quantitative delle porzioni)	2014
Latvia	Dietary guidelines for adults (Latvian: *Veselīga uztura ieteikumi pieaugušajiem*).	2008
Lithuania	Healthy diet recommendations (Lithuanian: sveikos mitybos rekomendacijos)	2010
Luxembourg	(French: le plaisir de bien manger et d'être actif!)	2011
Malta	Eat well for your health (Maltese: *Kul tajjeb għall-saħħtek*)	2011
Netherlands	(Dutch: Richtlijnen Goede voeding; Gezond eten met de Schijf van Vijf)	2015
Norway	Norwegian guidelines on diet, nutrition and physical activity. 2014 (Norwegian: *Anbefalinger om kosthold, ernæring og fysisk aktivitet*).	2014
Poland	Principles of healthy eating (Polish: *Zasady zdrowego żywienia*).	2010

Portugal	A nova roda dos alimentos, um guia para uma escolha alimentar diária – instituo do consumidor, faculdade de ciênicas da nutrição e alimentação da universade do porto	2014
Romania	Guidelines for a healthy diet (Romanian: *Reguli pentru o alimentaţie sănătoasă*).	2006
Russia	/	
Slovakia	/	
Slovenia	12 steps to healthy eating (Slovene: *12 korakov do zdravega prehranjevanja*).	2012
	The 'Food guide pyramid' (Slovene: *Z zdravo prehrano in gibanjem do zdravja*)	2015
Spain	Eat healthy and move: 12 healthy decisions (Spanish: *Come sano y muévete: 12 decisiones saludables*).	2008
	Guía de la alimentación saludable – SENC Sociedad Espanola Nutricion Comunitaria	2007
Sweden	Find your way to eat greener, not too much and to be active!	2015
Switserland	The Swiss food pyramid (German: *Lebensmittelpyramide*).	2011
The former Yugoslav Republic of Maceonia	Dietary guidelines for the population in The former Yugoslav Republic of Macedonia (Macedonian: *Водич за исхрана на населението во Република Македонија*).	2014
Turkey	Dietary guidelines for Turkey (Turkish: *Türkiye'ye Özgü Beslenme Rehberi*).	2014
United Kingdom	The Eatwell Guide – Public Health England in association with the Welsh Government, Food Standards Scotland and the Food Standards Agency in Northern Ireland	2016

APPENDIX II: Set of food-based dietary guidelines

- Food-based dietary guidelines summarise knowledge regarding food and nutrient intakes
- Foods are the common denominator for linking different dietary indicators (e.g. health, sustainability, consumers' choices)
- Translation to consumers is easy

Table II.1 Summary dietary guidelines of Denmark, Czech Republic, Italy, France, and the Netherlands, and the common set of food-based dietary guidelines

Food based guidelines	DK	CZ	IT	FR	NL	Common set
Grains and grain-based products						
Including cereals and primary derivatives; bread and similar products; pasta, dough and similar products; fine bakery wares; and breakfast cereals	Min 75g/day of whole grains in bread, grain, flour, cereals, rice and pasta	3 – 6 servings a day 1 serving = 1 slice of bread (60g), 1 bread roll, 1 cup of oat flakes or muesli, 1 cup of boiled or steamed rice or pasta (125g)	Bread: 3 – 6 servings a day; bakery wares: 1 – 2 servings a day Pasta/rice: 1 serving a day Potato: 1 – 2 servings a week 1 serving = 50g bread, 80g pasta, rice, etc., 30g bread substitutes like biscuits, crackers, breadsticks, etc., 30g sweet-baked products, 30g breakfast cereals, 200g potato	Quantity or frequency to be defined	Eat daily at least 90 grams of brown bread, wholemeal bread or other whole grain products.	
Replace refined grain products by whole grain products	✓	✓	✓ Plus not adding too much fat dressings	✓		Shift/Replacement - Refined grains vs whole grains
Vegetables and vegetable products						
Including leafy vegetables; sprouts, shoots and similar; flowering brassica; flowers used as vegetables; stems/stalks eaten as vegetables; bulb vegetables; legumes with pod; fruiting vegetables; root and tuber vegetables (excluding starchy- and sugar-); algae and	At least 300 grams per day, preferably the coarse vegetables Combined with fruit: minimum 600 grams per day	3 – 5 servings per day (300 – 500 grams per day) Raw and cooked or steamed vegetables	2 servings per day 1 serving = 200g raw or cooked vegetables, 80g leafy vegetables	Combined with fruit: minimum 5 servings fruit and vegetables per day 1 serving = 80 – 100g	Eat at least 200 grams of vegetables	**Minimum intake cut-off** Eat at least 200 grams of vegetables a day

prokaryotes organisms; fungi, mosses and lichens; herbs and edible flowers; processed or preserved vegetables and similar						
Starchy roots or tubers and products thereof, sugar plants						
Including starchy roots and tubers such as potatoes	140 grams of potatoes per day as part of a healthy diet		Included in the grain food group			No guideline.
Legumes, nuts, oilseeds and spices						
Legumes Including legumes fresh seeds (beans, peas, etc.); and pulses (dried legume seeds)	Legumes are included in vegetables	Included in the meat guideline		Considered as a group by itself. Quantity to be defined	Eat legumes weekly	**Minimum intake cut-off** Eat at least one serving of legumes per week (1 serving is 135 grams a week ≈ 19/day)
Nuts, oilseeds and oilfruits Including tree nuts; and oilseeds	Up to approx. 30 grams per day		Included in the fruit group	Considered as a group by itself. Quantity to be defined	Eat daily at least 15 gram of unsalted nuts	**Minimum intake cut-off** Eat at least 15 grams of unsalted nuts or seeds a day
Fruit and fruit products						
Including fruit used as fruit; and processed fruit products only dried fruit food group	Combined with vegetables: minimum 600 grams per day	2 – 4 servings per day (200 – 400 g/day) Preferably raw fruit and undiluted fruit juice	3 – 4 servings a day 1 serving = 150g fresh fruit, 30g nuts, 30g dried fruit	Combined with vegetables: minimum 5 servings fruit and vegetables per day 1 serving = 80 – 100g	Eat at least 200 grams of fruit	Eat at least 200 grams of fruit a day
Meat and meat products						
Including mammals and bird meats; processed whole meat products; sausages; meat specialities; ...		1 – 2 servings per day 1 serving = 125g meat, poultry or fish, 2 boiled egg whites, a bowl of soya beans, lentils or beans	1 – 2 servings per day 1 serving = 100g meat or poultry, 50g processed meat, 150g fish and shellfish, 50g processed fish and shellfish, 50g eggs		Eat daily 1-2 portions of meat, poultry, fish, eggs, legumes	
Limit the consumption of **red meat**, particularly **processed meat**	✓ MAX 500 g/week from beef, veal, lamb or pork; prepared weight, not raw weight			✓ Max 500g / week for red meat Processed meat to be limited as possible and max 25g/d	✓ MAX 500 grams of meat per week, of which MAX 300 grams or red meat per week	**Maximum intake cut-off** Eat at most 500 grams of red meat a week (≈71g/day); prepared weight
Choose lean meat, lean cold meats and/or poultry instead of fat and/or red meat	✓ Mainly low-fat (MAX 10%fat) No limit for poultry	✓	✓ Choose lean meat and remove visible fat	✓ Choose the variety of species and less fatty species		Shift/Replacement - fatty vs lean meat - red/processed vs white meat

Fish, seafood, amphibians, reptiles and invertebrates						
Including fish(meat); crustaceans; molluscs; fish and seafood processed	350g/week, preferably up to approx. 200g/week of oily fish (2 times a week in a hot meal and several times a week on bread (cold bread meals))	1 – 2 servings per week (170 – 340g/week)	2 – 3 times a week (300-450g/week)	2 times a week (200g/week) including one fatty fish	Eat weakly 1- 2 servings of fish, preferably oily fish (e.g. salmon, herring, mackerel, eel, trout, sardines, etc.)	**Minimum intake cut-off** Eat at least one serving of fish a week (105g/week≈15g/day)
Milk and dairy products						
Including milk and cream; fermented milk or cream; dairy desserts and similar	250 – 500 g/day, excluding cheese Cheese: when eating healthy 1 – 2 slices a day (25g)	2 – 3 servings a day 1 serving = 250ml low-fat milk, 200ml low-fat yoghurt, 55g cheese, 40g cottage cheese	3 servings a day 1 servings =125ml milk, 125g yoghurt, 100g fresh cheese, 50g hard cheese	3 servings a day 1 servings =200ml milk, 125g yoghurt, 100g fromage blanc, 60g petit suisse, 30g cheese	Take daily of few portions dairy products, including milk or yoghurt 2 – 3 servings of dairy per day	**Minimum intake cut-off** Eat at least 300 grams of dairy products a day (including milk, yoghurt, fresh cheese, quark, custard, milk puddings, etc.)
Choose low fat dairy	✓	✓				Shift/replacement - Whole vs low-fat dairy
Cheese	MAX 17%fat (30+)		2 – 3 servings a week, but smaller amounts		40 grams of cheese, and give preference to cheeses with high calcium, less fat, less salt	**Maximum intake cut-off** Eat at most 150 grams of cheese a week (≈21g/day)
Eggs and eggs products						
Including unprocessed eggs; and processed eggs	No guidelines	Included in the meat group	4 eggs per week Included in the meat group	Considered as a group by itself. Quantity to be defined	Included in the meat group; 2 – 3 eggs per week	No guideline.
Sugar and similar, confectionary and water-based sweet desserts						
Sugar and similar, confectionary and water-based sweet desserts	Limit (or reduce sugar rich foods and sugar-sweetened beverages Max ½ l soft drink, juice or energy drink per week					No guideline.
Animal and vegetable fats and oils and primary derivatives thereof						
Including animal and vegetables fats/oils; fat emulsions and blended fats (e.g. butter and margarines)	Limit the consumption of saturated fat containing fats	Only very moderately	3 servings per day 1 serving = 10mL extra virgin olive oil or seed oil	consider the fatty acids quality rather than total fatty acids quantity		No guideline.
Replace butter, hard **margarines and cooking fats** by soft	✓	✓ (plant oils instead of	✓	✓ Promote fats rich in		Shift/Replacement - Fats from butter, hard

margarines, liquid cooking fats, and vegetable oils.		animal fats)		ALA and limit fats rich in myristic, lauric and palmitic fatty acids		margarines and hard cooking fat vs fats from soft margarine, liquid cooking fat and vegetables oils
Fruit and vegetable juices and nectars (including concentrates)						
Including fruit juices (100% from named source); fruit nectars (min. 25 – 50% fruit); vegetable juices; other mixed fruit and vegetable juices or nectars; Including concentrated or dehydrated fruit/vegetable juices				Max 1 portion/d Portion = 1 glass		Included in the guideline on sugar-sweetened beverages
Water and water-based beverages						
Including drinking water	✓	✓ 1.5 – 2 L/day	✓ 1.5 – 2 L/day	✓	Drink as much water as you like	
Including soft drinks	✓ Max 0.5L/week of soda, juice or energy drinks	✓	✓	✓ As less as possible.	Minimise consumption of sugar-containing beverages	**Maximum intake cut-off** Drink at most 0.5 L of sugar-sweetened beverages a week (≈71 mL/day)
Alcoholic beverages						
Including beer and beer-like beverages; wine and wine-like beverages; mixed alcoholic drinks; unsweetened spirits and liqueurs	Not in FBDGs – but separate guidelines: Men: max 14 glasses per week (20g/day); Women: max 7 glasses per week (10g/day); Max 5 glasses per occasion	. Avoid daily consumption MAX 20g alcohol a day	✓ Controlled quantities	✓ Not taken into account, because considered not necessary for good health	Do not drink alcohol or no more than one glass daily	**Maximum intake cut-off** Drink at most one serving of alcohol a day (10 g of ethanol a day≈ 13 mL/day)
Coffee, cocoa, tea and infusions						
					Drink daily three cups of tea Replace unfiltered by filtered coffee	No guideline No guideline
Food products for young populations Products for non-standardised diets, food imitates and food supplements (including meat and dairy imitates → soya drinks, tofu etc.) Composite dishes Seasoning, sauces and condiments						
Salt	Eat foods with less salt content NNR: Reduce salt intake gradually to 6 g/day MAX	5g salt a day, including salt hidden in food			Limit salt intake to 5-6 grams daily	**Maximum intake cut-off** Eat at most 6 grams of salt a day
Use salt fortified with iodine	✓		✓			
Major isolated ingredients, additives, flavours, baking and processing aides						

Background including references to support the set of food-based dietary guidelines:

Food-based dietary guidelines are nationally-defined and are thus per definition different for each country. However, in this project we attempt to establish one set of food-based dietary guidelines for all countries in EU by selecting dietary factors that are important to either disease burden or policy, and hereby defining a cut-off representing the minimum and/or maximum level of exposure to promote health and minimise disease risk. For each dietary factor, these cut-offs points of optimal intake were derived from literature and from the national food-based dietary guidelines of Denmark, Czech Republic, Italy and France (EU countries representative for the EU diversity in food patterns of Scandinavia, Central East Europe, Mediterranean region and Western Europe).
(Note that the provided literature references are those for which the quality of evidence was high.)

Whole grains

Exposure definition

Whole grains (bran, germ, and endosperm in their natural proportion) from breakfast cereals, bread, rice, pasta, biscuits, muffins, tortillas, pancakes and other sources

Literature

- An intake of 90 grams whole grains per day (equivalent to 3 servings per day) is associated with a 26% lower risk of coronary heart disease (Anderson, Hanna et al. 2000).
- An average intake of 60 grams whole grains per day is associated with a 25% lower risk of type 2 diabetes (Ye, Chacko et al. 2012) (Aune, Norat et al. 2013).
- An intake of 90 grams whole grains per day is associated with a 10% lower risk of colorectal cancer (Aune, Chan et al. 2011).

Cut-off value for the common-set of food-based dietary guidelines

No cut-off is set, because total wholegrain intake is difficult to measure, however guideline on the replacement of white grains by wholegrains is included.

Vegetables

Exposure definition

All kind of vegetables (including fresh, dried, tinned or canned vegetable products, but excluding vegetable juices and vegetables from soup, sauces and ready-to-eat products).

Examples:

- Green leafy vegetables: spinach, chard, endive lettuce, lettuce, watercress, beet leaves
- Fruit-bearing vegetables: tomatoes, paprika, avocado, courgette, cucumber, artichoke, aubergine, pumpkin
- Root vegetables: carrots, radish, calcifies, red beet, turnip, celeriac, rape
- Cabbage root: broccoli, cabbage, Brussels sprout, cauliflower
- Onion and garlic: garlic, onion, shallot, Spring onion
- Stalk crops: seeds, leek, celery, fennel, asparagus, bean sprouts, bamboo shoots
- Others: peas, horse bean, corn, fungus, mushroom, mixed salads, mixed vegetables

Literature

- An intake of 250 grams of vegetables per day is associated with a 10% lower risk of coronary heart disease compared to an intake of 125 grams per day (Dauchet, Amouyel et al. 2006, He, Nowson et al. 2007, Crowe, Roddam et al. 2011).

Per 400 grams of vegetables per day, a 18% lower risk of coronary heart disease (Gan, Tong et al. 2015).

- Per 200 grams of vegetables per day, a 10% lower risk of stroke (Hu, Huang et al. 2014).

- An intake of 250 grams of vegetables per day is associated with a 10% lower risk of colorectal cancer compared to an intake of 100 grams per day (Aune, Lau et al. 2011).

Cut-off value for the common-set of food-based dietary guidelines

Minimum of 200 grams of vegetables a day.

Legumes

Exposure definition

Legumes include kidney beans, pinto beans, white beans, black beans, garbanzo beans (chickpeas), lima beans (mature, dried), split peas, lentils, and edamame (green soybeans).

Literature

- An intake of 130 grams of legumes per day is associated with a decrease in LDL cholesterol by 0.2 mmol/L compared to an intake of 130 grams of whole grains or vegetables per day (Bazzano, Thompson et al. 2011) (Ha, Sievenpiper et al. 2014).

Cut-off value for the common-set of food-based dietary guidelines

Minimum of 1 serving of legumes a week (135 grams a week ≈ 19 grams a day)

Nuts and seeds

Exposure definition

Walnuts, almonds, hazel, cashew, pistachio, macadamia, Brazil, pecan, pine nuts, flax seeds, sesame seeds, sunflower seeds, pumpkin seeds, poppy seeds, and peanut

Literature

- An intake of 35 grams of nuts or seeds per day is associated with a decrease in LDL cholesterol by 0.15 mmol/L (Sabaté, Oda et al. 2010) (Banel and Hu 2009, Pan, Yu et al. 2009).
- An intake of 15 grams of nuts per day is associated with a 20% lower risk for coronary heart disease (Luo, Zhang et al. 2014) (Afshin, Micha et al. 2014)
- An intake of one serving of nuts per day (28 grams per day) is associated with a 30% lower risk for all-cause mortality and a 40% lower risk for CVD mortality; an intake of one serving of nuts per week (4 grams per day) is associated with a 4% lower risk for all-cause mortality and a 7% lower risk for CVD mortality (Grosso, Yang et al. 2015).

Cut-off value for the common-set of food-based dietary guidelines

Minimum of 15 grams of unsalted nuts or seeds a day

Fruit

Exposure definition

All kind of fruits (including fresh, dried, tinned or canned fruit products, but excluding fruit juice)

For example:

- Citrus fruit: grapefruit, orange, mandarin, lemon
- Fruit (non-citrus): apple, pear, grape, apricot, cherry, peach, plum and prunes, nectarine, melon, pineapple, strawberry, raspberry, blueberry, banana, kiwi

Literature

- An intake of 250 grams of fruit per day is associated with a 10% lower risk of coronary heart disease compared to an intake of 50 grams per day (Dauchet, Amouyel et al. 2006, He, Nowson et al. 2007, Crowe, Roddam et al. 2011).

Per 300 grams of fruit intake, a 16% lower risk of coronary heart disease (Gan, Tong et al. 2015).

- Per 200 grams of fruit intake, a 30% lower risk of stroke (Hu, Huang et al. 2014).
- An intake of 300 grams of fruit per day is associated with a 10% lower risk of type 2 diabetes compared to 50 grams per day (Cooper, Forouhi et al. 2012, Muraki, Imamura et al. 2013).
- An intake of 300 grams of fruit per day is associated with a 10% lower risk of colorectal cancer compared to 100 grams per day (Aune, Lau et al. 2011).

- An intake of 200 grams of fruit per day is associated with a 10% lower risk of lung cancer compared to 50 grams per day (Büchner, Bueno-de-Mesquita et al. 2010).

Cut-off value for the common-set of food-based dietary guidelines

Minimum of 200 grams of fruit a day.

Meat

Exposure definition

Red meat: all mammalian muscle meat, including beef, veal, pork, lamb, mutton, horse and goat

Processed meat: meat that has been transformed through salting, curing, fermentations, smoking or other processed to enhance flavour or improve preservation (e.g. meat products as sandwich filling, ready-to-eat minced meat, sausages, etc.)

White meat: meat from all kind of poultry

Literature

- An intake of 100 – 120 grams of red meat per day is associated with a 10% higher risk for stroke (Kaluza, Wolk et al. 2012).
- An intake of 100 grams of red meat per day is associated with a 15% higher risk for type 2 diabetes (Aune, Ursin et al. 2009, Feskens, Sluik et al. 2013, Pan, Sun et al. 2013).
- An intake of 100 grams of red meat per day is associated with a 10% higher risk for colorectal cancer (Huxley, Ansary-Moghaddam et al. 2009, Norat, Chan et al. 2010, Alexander, Weed et al. 2011, Chan, Lau et al. 2011).
- An intake of 100 – 120 grams or red meat is associated with a 20% higher risk for lung cancer (Yang, Wong et al. 2012, Xue, Gao et al. 2014).
- An intake of 100 – 120 grams of unprocessed red meat is associated with a 10% higher risk for stroke (Kaluza, Wolk et al. 2012).
- An intake of 100 grams of unprocessed red meat is associated with a 15% higher riks for type 2 diabetes (Feskens, Sluik et al. 2013, Pan, Sun et al. 2013).
- An intake of 50 grams of processed meat per day is associated with a 10% higher risk for stroke (Kaluza, Wolk et al. 2012, Chen, Lv et al. 2013).
- An intake of 50 grams of processed meat per day is associated with a 20% higher risk for type 2 diabetes (Aune, Ursin et al. 2009, Micha, Wallace et al. 2010, Pan, Sun et al. 2011).
- An intake of 50 grams of processed meat per day is associated with a 15% higher risk for colorectal cancer (Huxley, Ansary-Moghaddam et al. 2009, Alexander, Miller et al. 2010, Norat, Chan et al. 2010, Spencer, Key et al. 2010).

Cut-off value for the common-set of food-based dietary guidelines

Maximum of 500 grams of red meat (including processed meat) a week (≈71 grams a day)

Guideline on replacement of red and processed meat by white meat

Fish

Exposure definition

All kind of fish and fish products

Literature

- An intake of one serving of fish a week is associated with a 15% lower risk for fatal coronary heart disease compared to less than one serving of fish per month (Zheng, Huang et al. 2012).
- An intake of at least 5 servings of fish a week is associated with a 20% lower risk for non-fatal coronary heart disease compared to less than one serving of fish per month (He, Song et al. 2004).
- An intake of one serving of fish a week is associated with a 10% lower risk for stroke compared to less than one serving of fish per month (He, Song et al. 2004, Bouzan, Cohen et al. 2005, Larsson and Orsini 2011, Chowdhury, Stevens et al. 2012, Xun, Qin et al. 2012).

Cut-off value for the common-set of food-based dietary guidelines

Minimum of 1 serving of fish a week (105 grams a week ≈ 15 grams a day)

Milk and milk products

Exposure definition

Food products produced from the milk of mammals, including milk, yoghurt, fresh cheese, quark, custard, milk puddings, cheese, butter, etc.

Literature

- An intake of 400 grams of total dairy products per day (dairy including milk… and cheese) is associated with a 15% lower risk for colorectal cancer (Aune, Lau et al. 2012).
- An intake of 200 grams of total milk (excluding cheese and butter) is associated with a10% lower risk of colorectal cancer; but no significant risk reduction for cheese (Ralston, Truby et al. 2014).

Cut-off value for the common-set of food-based dietary guidelines

Minimum of 300 g of total dairy products a day

Maximum of 150 grams of cheese a week (≈21grams a day)

Eggs

Exposure definition

All kind of eggs and egg products

Literature

- The intake of dietary cholesterol from eggs (when consuming ½ egg per day) is associated with an increase in LDL cholesterol by 0.050 mmol/L per day (Weggemans, Zock et al. 2001).
- The intake of at least 1 egg a day is associated with a 40% higher risk for type 2 diabetes compared to 1 egg a week (Shin, Xun et al. 2013).

Cut-off value for the common-set of food-based dietary guidelines

No cut-off is set, because of no convincing/sufficient evidence.

Fats and oils

Exposure definition

Fats from butter and hard margarines vs fats from soft margarine or oils

Literature

- Replacing 10 E% from butter by 10 E% from soft margarine is associated with a decrease in LDL cholesterol by 0.20 mmol/L (Zock and Katan 1997, Hendriks, Weststrate et al. 1999, Tonstad, Strøm et al. 2001).

Cut-off value for the common-set of food-based dietary guidelines

No cut-off is set, however guideline on the replacement of fats from butter and hard margarines by fats from soft margarines or oils.

Sugar-sweetened beverages

Exposure definition

Cold beverages with added sugars (sucrose, fructose or glucose), for example fruit juices, fruit nectars, soft drinks, ice teas, vitamin-water or sports drinks with added sugars, excluding 100% fruit juices without added sugars

Literature

- A daily intake of sugar-sweetened beverages is associated with an increase of body weight by 1 kilogram per month compared to a daily intake of beverages without added sugars, in an adult population (Malik, Pan et al. 2013).
- An intake of 330 ml sugar-sweetened beverages per day is associated with a 20% higher risk for type 2 diabetes (Greenwood, Threapleton et al. 2014, Xi, Li et al. 2014).

Cut-off value for the common-set of food-based dietary guidelines

Maximum of 500 mL of sugar-sweetened beverages a week (≈ 71 mL a day).

Guideline on replacement of sugar-sweetened beverages by drinking water, coffee and tea.

Alcoholic beverages

Exposure definition

Alcohol beverages include beer and beer-like beverage, wine and wine-like beverage, mixed alcoholic drinks and unsweetened spirits and liqueurs. One serving of an alcoholic beverage contains 10 gram of alcohol equivalent to 250 mL of beer (5% alcohol), 100 mL of wine (12% alcohol) and 35 mL of liquor (35% alcohol).

Literature

- A daily intake of 10 – 20 gram alcohol from beer versus >0 – 3 grams is associated with a 10% higher risk for all-cause mortality in males and a 15% higher risk in females (Ferrari, Licaj et al. 2014).
- A daily intake of >0 – 10 grams alcohol from wine versus no alcoholic intake from wine is associated with a 30% lower risk for all-cause mortality in males and a 20% lower risk in females. But a daily intake of >20 grams alcohol from wine versus >0 – 3 grams is associated with a 20% higher risk for all-cause mortality in males and 15% higher risk in females (Ferrari, Licaj et al. 2014).
- Beer consumption in males is associated with a 15% higher risk for type 2 diabetes compared to non-beer drinkers (Costanzo, Di Castelnuovo et al. 2011).
- A daily intake of 0.1 – 12 grams alcohol from liqueur versus no alcoholic intake from liqueur is associated with a 10% higher risk for type 2 diabetes (Beulens, van der Schouw et al. 2012).
- A daily intake of 20 – 40 grams alcohol from beer versus >0 – 3 grams is associated with a 35% higher risk for colorectal cancer (Cho, Smith-Warner et al. 2004, Ferrari, Jenab et al. 2007).
- A daily intake of 20 – 40 grams alcohol from wine versus > 0 – 3 grams is associated with a 20% higher risk for colorectal cancer (Cho, Smith-Warner et al. 2004, Ferrari, Jenab et al. 2007).
- A low intake of alcohol from beer (>0 - <5 grams for females and 5 – 15 grams per day for males) versus non-alcohol intake from beer is associated with a 20% lower risk for lung cancer (Chao 2007).
- A daily intake of ≥15 grams alcohol from beer versus non-alcoholic intake from beer is associated with a 90% higher risk of lung cancer in females (Freudenheim, Ritz et al. 2005, Chao 2007).
- A daily intake of >0 - <12 grams alcohol from wine versus non-alcoholic intake from wine is associated with a 25% lower risk of lung cancer (Freudenheim, Ritz et al. 2005, Chao 2007).
- A daily intake of ≥15 grams alcohol from liquor versus non-alcoholic intake from liquor is associated with a 35% higher risk for lung cancer in males (Freudenheim, Ritz et al. 2005, Chao 2007).

Cut-off value for the common-set of food-based dietary guidelines

Maximum of 1 serving of alcohol a day (1 serving contains 10 grams of alcohol equivalent to 13 mL of alcohol)

Salt

Exposure definition

Salt present in foods and salt added during cooking and at the table.

Literature

- A decrease in the intake of Sodium of 1.8 grams per day is associated with a decrease in systolic blood pressure of 5 mmHg in a hypertensive and 2 mmHg in a normotensive adult population (Graudal, Hubeck-Graudal et al. 2012, Aburto, Ziolkovska et al. 2013, He, Li et al. 2013).

Cut-off value for the common-set of food-based dietary guidelines

Maximum of 6 grams of salt a day

References

Aburto, N. J., A. Ziolkovska, L. Hooper, P. Elliott, F. P. Cappuccio and J. J. Meerpohl (2013). "Effect of lower sodium intake on health: systematic review and meta-analyses."

Afshin, A., R. Micha, S. Khatibzadeh and D. Mozaffarian (2014). "Consumption of nuts and legumes and risk of incident ischemic heart disease, stroke, and diabetes: a systematic review and meta-analysis." The American journal of clinical nutrition 100(1): 278-288.

Alexander, D. D., A. J. Miller, C. A. Cushing and K. A. Lowe (2010). "Processed meat and colorectal cancer: a quantitative review of prospective epidemiologic studies." European journal of cancer prevention 19(5): 328-341.

Alexander, D. D., D. L. Weed, C. A. Cushing and K. A. Lowe (2011). "Meta-analysis of prospective studies of red meat consumption and colorectal cancer." European Journal of Cancer Prevention 20(4): 293-307.

Anderson, J. W., T. J. Hanna, X. Peng and R. J. Kryscio (2000). "Whole grain foods and heart disease risk." Journal of the American College of Nutrition 19(sup3): 291S-299S.

Aune, D., D. S. Chan, R. Lau, R. Vieira, D. C. Greenwood, E. Kampman and T. Norat (2011). "Dietary fibre, whole grains, and risk of colorectal cancer: systematic review and dose-response meta-analysis of prospective studies." Bmj 343: d6617.

Aune, D., R. Lau, D. Chan, R. Vieira, D. Greenwood, E. Kampman and T. Norat (2012). "Dairy products and colorectal cancer risk: a systematic review and meta-analysis of cohort studies." Annals of oncology 23(1): 37-45.

Aune, D., R. Lau, D. S. Chan, R. Vieira, D. C. Greenwood, E. Kampman and T. Norat (2011). "Nonlinear reduction in risk for colorectal cancer by fruit and vegetable intake based on meta-analysis of prospective studies." Gastroenterology 141(1): 106-118.

Aune, D., T. Norat, P. Romundstad and L. J. Vatten (2013). "Whole grain and refined grain consumption and the risk of type 2 diabetes: a systematic review and dose–response meta-analysis of cohort studies." European journal of epidemiology 28(11): 845-858.

Aune, D., G. Ursin and M. Veierød (2009). "Meat consumption and the risk of type 2 diabetes: a systematic review and meta-analysis of cohort studies." Diabetologia 52(11): 2277-2287.

Banel, D. K. and F. B. Hu (2009). "Effects of walnut consumption on blood lipids and other cardiovascular risk factors: a meta-analysis and systematic review." The American journal of clinical nutrition 90(1): 56-63.

Bazzano, L. A., A. M. Thompson, M. T. Tees, C. H. Nguyen and D. M. Winham (2011). "Non-soy legume consumption lowers cholesterol levels: a meta-analysis of randomized controlled trials." Nutrition, Metabolism and Cardiovascular Diseases 21(2): 94-103.

Beulens, J., Y. T. van der Schouw, M. M. Bergmann, S. Rohrmann, M. B. Schulze, B. Buijsse, D. E. Grobbee, L. Arriola, S. Cauchi and M. J. Tormo (2012). "Alcohol consumption and risk of type 2 diabetes in European men and women: influence of beverage type and body sizeThe EPIC–InterAct study." Journal of internal medicine 272(4): 358-370.

Bouzan, C., J. T. Cohen, W. E. Connor, P. M. Kris-Etherton, G. M. Gray, A. König, R. S. Lawrence, D. A. Savitz and S. M. Teutsch (2005). "A quantitative analysis of fish consumption and stroke risk." American journal of preventive medicine 29(4): 347-352.

Büchner, F., H. Bueno-de-Mesquita, J. Linseisen, H. Boshuizen, L. Kiemeney, M. Ros, K. Overvad, L. Hansen, A. Tjonneland and O. Raaschou-Nielsen (2010). "Fruits and vegetables consumption and the risk of histological subtypes of lung cancer in the European Prospective Investigation into Cancer and Nutrition (EPIC)." Cancer Causes & Control 21(3): 357-371.

Chan, D. S., R. Lau, D. Aune, R. Vieira, D. C. Greenwood, E. Kampman and T. Norat (2011). "Red and processed meat and colorectal cancer incidence: meta-analysis of prospective studies." PloS one 6(6): e20456.

Chao, C. (2007). "Associations between beer, wine, and liquor consumption and lung cancer risk: a meta-analysis." Cancer Epidemiology Biomarkers & Prevention 16(11): 2436-2447.

Chen, G., D. Lv, Z. Pang and Q. Liu (2013). "Red and processed meat consumption and risk of stroke: a meta-analysis of prospective cohort studies." European journal of clinical nutrition 67(1): 91-95.

Cho, E., S. A. Smith-Warner, J. Ritz, P. A. van den Brandt, G. A. Colditz, A. R. Folsom, J. L. Freudenheim, E. Giovannucci, R. A. Goldbohm and S. Graham (2004). "Alcohol intake and colorectal cancer: a pooled analysis of 8 cohort studies." Annals of internal medicine 140(8): 603-613.

Chowdhury, R., S. Stevens, D. Gorman, A. Pan, S. Warnakula, S. Chowdhury, H. Ward, L. Johnson, F. Crowe and F. B. Hu (2012). "Association between fish consumption, long chain omega 3 fatty acids, and risk of cerebrovascular disease: systematic review and meta-analysis."

Cooper, A. J., N. G. Forouhi, Z. Ye, B. Buijsse, L. Arriola, B. Balkau, A. Barricarte, J. W. Beulens, H. Boeing and F. L. Büchner (2012). "Fruit and vegetable intake and type 2 diabetes: EPIC-InterAct prospective study and meta-analysis." European journal of clinical nutrition 66(10): 1082-1092.

Costanzo, S., A. Di Castelnuovo, M. B. Donati, L. Iacoviello and G. de Gaetano (2011). "Wine, beer or spirit drinking in relation to fatal and non-fatal cardiovascular events: a meta-analysis." European journal of epidemiology 26(11): 833-850.

Crowe, F. L., A. W. Roddam, T. J. Key, P. N. Appleby, K. Overvad, M. U. Jakobsen, A. Tjønneland, L. Hansen, H. Boeing and C. Weikert (2011). "Fruit and vegetable intake and mortality from ischaemic heart disease: results from the European Prospective Investigation into Cancer and Nutrition (EPIC)-Heart study." European Heart Journal 32(10): 1235-1243.

Dauchet, L., P. Amouyel, S. Hercberg and J. Dallongeville (2006). "Fruit and vegetable consumption and risk of coronary heart disease: a meta-analysis of cohort studies." The Journal of nutrition 136(10): 2588-2593.

Ferrari, P., M. Jenab, T. Norat, A. Moskal, N. Slimani, A. Olsen, A. Tjønneland, K. Overvad, M. K. Jensen and M. C. Boutron-Ruault (2007). "Lifetime and baseline alcohol intake and risk of colon and rectal cancers in the European prospective investigation into cancer and nutrition (EPIC)." International journal of cancer 121(9): 2065-2072.

Ferrari, P., I. Licaj, D. C. Muller, P. K. Andersen, M. Johansson, H. Boeing, E. Weiderpass, L. Dossus, L. Dartois and G. Fagherazzi (2014). "Lifetime alcohol use and overall and cause-specific mortality in the European Prospective Investigation into Cancer and nutrition (EPIC) study." BMJ open 4(7): e005245.

Feskens, E. J., D. Sluik and G. J. van Woudenbergh (2013). "Meat consumption, diabetes, and its complications." Current diabetes reports 13(2): 298-306.

Freudenheim, J. L., J. Ritz, S. A. Smith-Warner, D. Albanes, E. V. Bandera, P. A. van den Brandt, G. Colditz, D. Feskanich, R. A. Goldbohm and L. Harnack (2005). "Alcohol consumption and risk of lung cancer: a pooled analysis of cohort studies." The American journal of clinical nutrition 82(3): 657-667.

Gan, Y., X. Tong, L. Li, S. Cao, X. Yin, C. Gao, C. Herath, W. Li, Z. Jin and Y. Chen (2015). "Consumption of fruit and vegetable and risk of coronary heart disease: a meta-analysis of prospective cohort studies." International journal of cardiology 183: 129-137.

Graudal, N. A., T. Hubeck-Graudal and G. Jürgens (2012). "Effects of low-sodium diet vs. high-sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride (Cochrane Review)." American journal of hypertension 25(1): 1-15.

Greenwood, D., D. Threapleton, C. Evans, C. Cleghorn, C. Nykjaer, C. Woodhead and V. Burley (2014). "Association between sugar-sweetened and artificially sweetened soft drinks and type 2 diabetes: systematic review and dose–response meta-analysis of prospective studies." British Journal of Nutrition 112(05): 725-734.

Grosso, G., J. Yang, S. Marventano, A. Micek, F. Galvano and S. N. Kales (2015). "Nut consumption on all-cause, cardiovascular, and cancer mortality risk: a systematic review and meta-analysis of epidemiologic studies." The American journal of clinical nutrition 101(4): 783-793.

Ha, V., J. L. Sievenpiper, R. J. de Souza, V. H. Jayalath, A. Mirrahimi, A. Agarwal, L. Chiavaroli, S. B. Mejia, F. M. Sacks and M. Di Buono (2014). "Effect of dietary pulse intake on established therapeutic lipid targets for cardiovascular risk reduction: a systematic review and meta-analysis of randomized controlled trials." Canadian Medical Association Journal 186(8): E252-E262.

He, F., C. Nowson, M. Lucas and G. MacGregor (2007). "Increased consumption of fruit and vegetables is related to a reduced risk of coronary heart disease: meta-analysis of cohort studies." Journal of human hypertension 21(9): 717-728.

He, F. J., J. Li and G. A. MacGregor (2013). "Effect of longer term modest salt reduction on blood pressure: Cochrane systematic review and meta-analysis of randomised trials."

He, K., Y. Song, M. L. Daviglus, K. Liu, L. Van Horn, A. R. Dyer, U. Goldbourt and P. Greenland (2004). "Fish Consumption and Incidence of Stroke A Meta-Analysis of Cohort Studies." Stroke 35(7): 1538-1542.

He, K., Y. Song, M. L. Daviglus, K. Liu, L. Van Horn, A. R. Dyer and P. Greenland (2004). "Accumulated evidence on fish consumption and coronary heart disease mortality a meta-analysis of cohort studies." Circulation 109(22): 2705-2711.

Hendriks, H., J. Weststrate, T. Van Vliet and G. Meijer (1999). "Spreads enriched with three different levels of vegetable oil sterols and the degree of cholesterol lowering in normocholesterolaemic and mildly hypercholesterolaemic subjects." European Journal of Clinical Nutrition 53(4): 319-327.

Hu, D., J. Huang, Y. Wang, D. Zhang and Y. Qu (2014). "Fruits and vegetables consumption and risk of stroke a meta-analysis of prospective cohort studies." Stroke 45(6): 1613-1619.

Huxley, R. R., A. Ansary-Moghaddam, P. Clifton, S. Czernichow, C. L. Parr and M. Woodward (2009). "The impact of dietary and lifestyle risk factors on risk of colorectal cancer: a quantitative overview of the epidemiological evidence." International journal of cancer 125(1): 171-180.

Kaluza, J., A. Wolk and S. C. Larsson (2012). "Red Meat Consumption and Risk of Stroke A Meta-Analysis of Prospective Studies." Stroke 43(10): 2556-2560.

Larsson, S. C. and N. Orsini (2011). "Fish consumption and the risk of stroke a dose–response meta-analysis." Stroke 42(12): 3621-3623.

Luo, C., Y. Zhang, Y. Ding, Z. Shan, S. Chen, M. Yu, F. B. Hu and L. Liu (2014). "Nut consumption and risk of type 2 diabetes, cardiovascular disease, and all-cause mortality: a systematic review and meta-analysis." The American journal of clinical nutrition 100(1): 256-269.

Malik, V. S., A. Pan, W. C. Willett and F. B. Hu (2013). "Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis." The American journal of clinical nutrition 98(4): 1084-1102.

Micha, R., S. K. Wallace and D. Mozaffarian (2010). "Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus a systematic review and meta-analysis." Circulation 121(21): 2271-2283.

Muraki, I., F. Imamura, J. E. Manson, F. B. Hu, W. C. Willett, R. M. van Dam and Q. Sun (2013). "Fruit consumption and risk of type 2 diabetes: results from three prospective longitudinal cohort studies."

Norat, T., D. Chan, R. Lau, D. Aune and R. Vieira (2010). "The associations between food, nutrition and physical activity and the risk of colorectal cancer." WCRF/AICR Systematic Literature Review Continuous Update Project Report. London: World Cancer Research Fund/American Institute for Cancer Research.

Pan, A., Q. Sun, A. M. Bernstein, J. E. Manson, W. C. Willett and F. B. Hu (2013). "Changes in red meat consumption and subsequent risk of type 2 diabetes mellitus: three cohorts of US men and women." JAMA internal medicine 173(14): 1328-1335.

Pan, A., Q. Sun, A. M. Bernstein, M. B. Schulze, J. E. Manson, W. C. Willett and F. B. Hu (2011). "Red meat consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis." The American journal of clinical nutrition 94(4): 1088-1096.

Pan, A., D. Yu, W. Demark-Wahnefried, O. H. Franco and X. Lin (2009). "Meta-analysis of the effects of flaxseed interventions on blood lipids." The American journal of clinical nutrition 90(2): 288-297.

Ralston, R. A., H. Truby, C. E. Palermo and K. Z. Walker (2014). "Colorectal cancer and nonfermented milk, solid cheese, and fermented milk consumption: a systematic review and meta-analysis of prospective studies." Critical reviews in food science and nutrition 54(9): 1167-1179.

Sabaté, J., K. Oda and E. Ros (2010). "Nut consumption and blood lipid levels: a pooled analysis of 25 intervention trials." Archives of internal medicine 170(9): 821-827.

Shin, J. Y., P. Xun, Y. Nakamura and K. He (2013). "Egg consumption in relation to risk of cardiovascular disease and diabetes: a systematic review and meta-analysis." The American journal of clinical nutrition: ajcn. 051318.

Spencer, E. A., T. J. Key, P. N. Appleby, C. C. Dahm, R. H. Keogh, I. S. Fentiman, T. Akbaraly, E. J. Brunner, V. Burley and J. E. Cade (2010). "Meat, poultry and fish and risk of colorectal cancer: pooled analysis of data from the UK dietary cohort consortium." Cancer causes & control 21(9): 1417-1425.

Tonstad, S., E. Strøm, C. Bergei, L. Ose and B. Christophersen (2001). "Serum cholesterol response to replacing butter with a new trans-free margarine in hypercholesterolemic subjects." Nutrition, metabolism, and cardiovascular diseases: NMCD 11(5): 320-326.

Weggemans, R. M., P. L. Zock and M. B. Katan (2001). "Dietary cholesterol from eggs increases the ratio of total cholesterol to high-density lipoprotein cholesterol in humans: a meta-analysis." The American journal of clinical nutrition 73(5): 885-891.

Xi, B., S. Li, Z. Liu, H. Tian, X. Yin, P. Huai, W. Tang, D. Zhou and L. M. Steffen (2014). "Intake of fruit juice and incidence of type 2 diabetes: a systematic review and meta-analysis." PLoS One 9(3): e93471.

Xue, X.-J., Q. Gao, J.-H. Qiao, J. Zhang, C.-P. Xu and J. Liu (2014). "Red and processed meat consumption and the risk of lung cancer: a dose-response meta-analysis of 33 published studies." International journal of clinical and experimental medicine 7(6): 1542.

Xun, P., B. Qin, Y. Song, Y. Nakamura, T. Kurth, S. Yaemsiri, L. Djousse and K. He (2012). "Fish consumption and risk of stroke and its subtypes: accumulative evidence from a meta-analysis of prospective cohort studies." European journal of clinical nutrition 66(11): 1199-1207.

Yang, W., M. Wong, E. Vogtmann, R. Tang, L. Xie, Y. Yang, Q. Wu, W. Zhang and Y. Xiang (2012). "Meat consumption and risk of lung cancer: evidence from observational studies." Annals of oncology: mds207.

Ye, E. Q., S. A. Chacko, E. L. Chou, M. Kugizaki and S. Liu (2012). "Greater whole-grain intake is associated with lower risk of type 2 diabetes, cardiovascular disease, and weight gain." The Journal of nutrition 142(7): 1304-1313.

Zheng, J., T. Huang, Y. Yu, X. Hu, B. Yang and D. Li (2012). "Fish consumption and CHD mortality: an updated meta-analysis of seventeen cohort studies." Public health nutrition 15(04): 725-737.

Zock, P. L. and M. B. Katan (1997). "Butter, margarine and serum lipoproteins." Atherosclerosis 131(1): 7-16.

APPENDIX III: Dietary Reference Values (DRVs) by the European Food Safety Authority (EFSA)

Macronutrients	Reference Intake Range	Adequate intake
Total fat	20 – 35 E%	
Saturated fatty acids	< 10 E% (Institute of Medicine)	
Mono-unsaturated fatty acids	15 – 20 E% (Institute of Medicine)	
Poly-unsaturated fatty acids	6 – 11 E% (Institute of Medicine)	
Omega-6 PUFA		LA: 4 E% AA: -
Omega-3 PUFA		ALA: 0.5 E% EPA + DHA: 250 mg
Trans-fatty acids	< 1E% (Institute of Medicine)	
Conjugated Linoleic Acid	-	-
Cholesterol	-	-
Carbohydrates	46 – 60 %E	
Added sugar	< 10% E	
Dietary fibre		25 g/day
Protein	10 – 35 % E (Institute of Medicine)	Average Requirement: 0.66 g/kg BW
Essential amino-acids	-	

Minerals and trace elements	Average Requirement	Adequate intake
Copper		Males: 1.6 mg/day Females:1.3 mg/day
Iron	Males: 6 mg/day Females: 7 mg/day	
Magnesium		Males:350 mg/day Females: 300 mg/day
Phosphorous		Males: 550 mg/day Females: 550 mg/day
Calcium	Males: 860 mg/day (≥ 25y 750) Females: 860 mg/day (≥ 25y 750)	
Selenium		Males: 70 µg/day Females: 70 µg/day
Zinc	Males: 7.5 mg/day (assuming BW 68.1 kg and phytate 300 mg/day) Females: 6.2 mg/day (assuming BW 58.5 kg and phytate 300 mg/day)	
Iodine		Males: 150 µg/day Females: 150 µg/day
Manganese		Males: 3 mg/day Females: 3 mg/day
Fluoride		Males: 3.4 mg/day Females: 2.9 mg/day
Molybdenum		Males: 65 µg/day Females: 65 µg/day
Potassium		Males: 3500 mg/day Females: 3500 mg/day
Sodium (Institute of Medicine)		Males: 1500 mg/day Females: 1500 mg/day

Vitamins	Average Requirement	Adequate intake
A	Males: 570 µg RE/day Females: 490 µg RE/day	
D		Males: 15 µg/day Females: 15 µg/day
E		Males: 13 mg/day Females: 11 mg/day
C	Males: 90 mg/day Females: 80 mg/day	
B1 (thiamine) (Institute of Medicine)	Males: 1.0 mg/day Females: 0.9 mg/day	
B2 (Riboflavin) (Institute of Medicine)	Males: 1.1 mg/day Females: 0.9 mg/day	
B3 (niacin)	Males: 1.3 mg/MJ Females: 1.3 mg/MJ	
B6	Males: 1.5 mg/day Females: 1.3 mg/day	
B12 (cobalamin)		Males: 4 µg/day Females: 4 µg/day
Folate	Males: 250 µg DFE/day Females: 250 µg DFE/day	
Pantothenic acid		Males: 5 mg/day Females: 5 mg/day
Biotin		Males: 40 mg/day Females: 40 mg/day

APPENDIX IV: Linkage with FoodEx2

The table provides an overview of food items from FoodEx2 that are included in the different food groups as presented in the common set of food-based dietary guidelines. A food group presented in the common set of food-based dietary guidelines can thus be regarded as the sum of individual food items from the FoodEx2 classification system.

Table IV.1 Summary of the FoodEx2-codes that are included and excluded in the common set of food-based dietary guidelines.

		Level	Food codes included to calculate the dietary intake of this food group (level)	Food codes excluded
1	**Grains and grain-based products**	**1**		
	- Cereals and cereal primary derivatives	2		
	• Total intake		A00K(L2)	
	• Whole grain intake		A04KH(L4) + A000Y(L4) + A000F(L4) + A001E(L6) + A001H(L6) + A0D9R(L4) + A0D9A(L4) + A001M(L4) + A0BY1(L3) + A002C(L3) + A0ETN(L3)	A001X(L4)+ A0D9Y(L4) + A000S(L4) + A001F(L6) + A001G(L6) + A003D(L6) + A003E(L6) +A0F6M(L6) + A0CGL(L5) + A0CGM(L5) + A001J(L5) + A04KR(L4) + A001Y(L4) + A04KS(L3) + A0ETS(L3)
	- Bread and similar products			
	• Total intake	2	A004V(L2)	-
	• Wholegrain intake		A005D(L5) + A005E(L5) + A005H(L5) + A005J(L5) + A005P(L6) + A005Q(L5) + A005Y(L3) + A006B(L5) + A006E(L5) + A006P(L4) + A005T(L5)	A004Y(L5) + A005G(L5) + A005K(L5) + A0BB2(L4) + A04KY(L4) + A005N(L6) + A04KZ(L3) + A006C(L5) + A006F(L5) + A005Z(L3) + A006N(L4) + A005S(L5) + A006Z(L3)
	- Pasta, doughs and similar products			
	• Total intake	2	A04QT(L2)	-
	• Wholegrain intake		A04LC(L5) + A008C(L5)	A007F(L5) + A007L(L5) + A007R(L5) + A0ERE(L4) + A008B(L5) + A008D(L5) + A008E(L5) + A008G(L3)
	- Fine bakery wares			
	• Total intake	2	A009T(L2)	-
	• Wholegrain intake		A00AA(L5) + A00AB(L5) + A00AC(L5)	A009Y(L5) + A009Z(L5) + A00AD(L5) + A00AE(L4) + A00AG(L3) + A00AN(L3) +

				A00BK(L3) + A00BV(L3) + A00CC(L3) + A00CJ(L3)
	- Breakfast cereals			
	• Total intake	2	A00CV(L2)	-
	• Wholegrain intake		A04LH(L3) + A00EY(L3) + A00EJ(L3) + A04LL(L4)	A04QY(L4)
2	**Vegetables and vegetable products**	**1**	A00FJ(L1)	-
3	**Starchy roots or tuber and products thereof, sugar plants**	**1**		
	- Potatoes	2	A00ZS(L2)	A0011C(L2) + A010R(L2)
4	**Legumes, nuts, oilseeds and spices**	**1**		A016S(L2)
	• Legumes		A04RG(L2) + A01AZ(L3)	A04RH(L2) + A01BJ(L3)
	• Nuts		A014C(L3) + A015F(L3)	A04RG(L2) + A016L(L3) + A01AY(L2)
5	**Fruit and Fruit products**	**1**	A04RK(L2) + A01MA(L3) + A01QJ(L4) + A01NN(L4)	A04MN(L3) + A01QE(L4)+ A01PS(L4) + A01QN(L4) + A01QM(L4) + A0CJA(L4)
6	**Meat and meat products**	**1**		A0EYE(L2) + A0BY5(L2) + A01TT(L2) + A0EYN(L2) + A020P(L2) + A0F1J(L2)
	• Red meat		A01TN(L4) + A01TP(L4) + A01TQ(L4) + A01QV(L4) + A01RG(L4) + A01RH(L4) + A01RL(L4) + A01RM(L4) + A01RT(L4) + A01RS(L4) + A01RY(L4) + A01SA(L4) + A01SH(L4) + A01SJ(L4) + A01SL(L4) + A01SM(L4) + A0F6A(L4) + A0F6B(L4) + A02KN(L4) + A01XD(L2) + A01YG(L2) + A0F1T(L2) + A01ZK(L2)	A01RQ(L4)
	• Processed meat		A04ND(L2) + A024F(L2) + A026J(L2) + A022L(L2) + A0EYQ(L2) + A024B(L2)	
	• White meat		A01RQ(L4) + A0EYG(L3)	A01TN(L4) + A01TP(L4) + A01TQ(L4) + A01QV(L4) + A01RG(L4) + A01RH(L4) + A01RL(L4) + A01RM(L4) + A01RT(L4) + A01RS(L4) + A01RY(L4) + A01SA(L4) + A01SH(L4) + A01SJ(L4) + A01SL(L4) + A01SM(L4) + A0F6A(L4) + A0F6B(L4) + A02KN(L4)
7	**Fish, seafood, amphibians, reptiles and invertebrates**	**1**		
	• Fish		A026V(L2) + A02EH(L2) + A02FD(L2) + A02GM(L2) + A02GN(L2) + A02GP(L2) +	A02KQ(L2)

			A02GY(L2) + A04NL(L2)	
8	**Milk and milk products**	**1**		
	• Dairy products (excluding butter and hard cheese)		A02LT(L3) + A02MK(L3) + A02MV(L3) + A02MZ(L2) + A02QF(L3) + A02QG(L4) + A02QK(L4) + A02QH(L4) + A02PV(L3) + A065H(L3)	A0EZB(L3) + A02PD(L2) + A02QH(L4) + A02QJ(L4) + A0CRN(L4) + A02QL(L4) + A04NV(L4) + A02RA(L3) + A02RG(L3) + A031A(L3) + A031A(L3) + A0F1H(L3) + A02PZ(L3) + A065Z(L3)
	• Hard cheese	2	A02QH(L4) + A02QJ(L4) + A0CRN(L4) + A02QL(L4) + A04NV(L4) + A02RA(L3) + A02RG(L3) + A031A(L3)	A02QG(L4) + A02QK(L4) + A02QH(L4) + A0FH(l3)
9	**Eggs and egg products**	**1**	A031E(L1)	-
~~10~~	***~~Sugar and similar, confectionary and water-based sweet desserts~~***	***1***	*Not included.*	
11	**Animal and vegetable fats and oils and primary derivatives thereof**	**1**		
	• Fats from butter, hard margarines and lard		A037L(L4) + A04PJ(L4) + A038L(L5) + A038R(L3) + A039C(L3) + A039D(L4) + A04SD(L3)	A036P(L4) + A036T(L4) + A038M(L5) + A039E(L4) + A039H(L4)
	• Fats from soft margarines and oils		A036P(L4) + A036T(L4) + A038M(L5) + A039E(L4) + A039H(L4)	A037L(L4) + A04PJ(L4) + A038L(L5) + A038R(L3) + A039C(L3) + A039D(L4) + A04SD(L3)
12	**Fruit and vegetable juices and nectars, including concentrates**	**1**		
13	**Water and water-based beverages**	**1**		
	• Sugar-sweetened beverages			
	○ Fruit and vegetable juices etc.		A039K(L1)	-
	○ Water-based beverages etc.		A04PY(L2) + A04PZ(L2)	A03DK(L2)
	• Drinking water		A03DK(L2)	A04PY(L2) + A049Z(L2)
14	**Alcoholic beverages**	**1**		
	• Beer and beer-like	2	A03MA(L2)	-
	• Wine and wine-like	2	A03MS(L2)	-
	• Mixed alcoholic drinks	2	A03PM(L2)	-
	• Unsweetened spirits and liqueurs	2	A04QF(L2)	-
15	**Coffee, cocoa, tea and infusions**	**1**		
	• Coffee		A03KA(L3)	A03GG(L2) + A03KL(L3) + A03KY(L3) + A03LB(L3) + A03LG(L3)

	• Tea		A03LB(L3)	A03GG(L2) + A03KA(L3) + A03KL(L3) + A03KY(L3) + A03LG(L3)
~~16~~	***Food products for young populations***	1	*Not included.*	
17	**Products for non-standard diets, food imitates and food supplements**	1		A03RR(L2) +
	• Food supplements and similar preparations	3	Vitamins and minerals: A03SK(L3) Fatty acids: A03SY(L4)	
	• Meat imitates	3	A03TE(L3)	
	• Dairy imitates	3	A0BXC(L3)	
~~18~~	***Composite dishes***	**1**	*Not included.*	
19	**Seasoning, sauces and condiments**	**1**		A043E(L3) + A0EQE(L2) + A04QN(L2) + A046F(L2) + A045J(L2)
	• Salt	4	A0429(L4)	A042Y(L4)
~~20~~	***Major isolated ingredients, additives, flavours, baking and processing aids***	***1***	*Not included.*	
~~21~~	***Other ingredients***	***1***	*Not included.*	

Background on the selection of the FoodEx2-codes

Whole grains

For the food group 'grains and grain-based products', the intake of total grains and more specifically the intake of whole grains are of interest. Hereby, a differentiation will be made for the following subcategories of level 2: cereals and cereal primary derivatives; bread and similar products; pasta, doughs and similar product; fine bakery wares; and breakfast cereals. What we need, therefore, is the intake of total grains for each subcategory of level 2, thus a total intake of 'cereals and cereal primary derivatives', 'bread and similar products', 'pasta, doughs and similar products', 'fine bakery wares', and 'breakfast cereals' separately. The intake of whole grains is calculated for each subcategory of level 2 separately as the sum of wholegrain food groups and/or wholegrain food items of that subcategory.

In general, whole grain intake refers to the intake of whole grains (bran, germ and endosperm in their natural proportion) from (breakfast) cereals, bread, rice, pasta, biscuits, muffins, tortillas, pancakes and other sources.

Vegetables

The intake of vegetables can be derived from the category 'vegetables and vegetable products' of level 1, hereby including all kind of vegetables as further specified in the subcategories of level 2 (i.e. leafy vegetables; sprouts, shoots and similar; flowering brassica; flowers used as vegetables; stems/stalks eaten as vegetables; bulb vegetables; legumes with pod; fruiting vegetables; root and tuber vegetables; algae and prokaryotes organisms; fungi, mosses and lichens; herbs and edible flowers; and processed or preserved vegetables and similar).

Potatoes

Only the subcategory 'starchy roots and tuber' of level 2 is considered as an estimate for potato intake, thus excluding dried potato products and all kind of sugar plants.

Legumes

The intake of legumes is calculated as the sum of the subcategory 'legumes' of level 2 and the subcategory 'canned or jarred legumes' of level 3 from the subcategory 'processed legumes, nuts, oilseeds and spices' of level 2.

Nuts and seeds

The intake of nuts and seeds is calculated as the sum of the subcategory 'tree nuts' and 'oil seeds' of level 3 from the subcategory 'nuts, oilseeds and oil fruits' of level 2. No differentiation is made between salted and unsalted nuts to enhance cross-country comparison despite of the differences in the level of detail of the dietary assessment.

Fruit

The intake of fruit is calculated as the sum of the subcategory 'fruit used as fruit' of level 2, and the subcategories 'dried fruit' of level 3 and the subcategories 'fruit or fruit-vegetable puree' and 'canned or jarred fruit' of level 4, belonging to the subcategory of 'processed fruit products' of level 2.

Meat

For the food group 'meat and meat products', a differentiation is made between red, processed and white meat.

The intake of red meat is calculate as the sum of subcategories 'bovine and pig fresh meat', 'mixed pork and mutton/lamb fresh meat', 'mixed beef and mutton/lamb fresh meat', 'bovine muscle', 'pig muscle', 'sheep muscle', 'goat muscle', 'equine muscle', 'camel fresh meat', 'kangaroo fresh meat', 'llama or lama fresh meat', 'deer fresh meat', 'wild boar fresh meat', 'hare fresh meat', 'mouflon fresh meat', 'chamois fresh meat' , 'dog meat', 'rat meat' and 'marine mammals meat' of level 4 from the subcategory 'mammals and birds meat' of level 2, and the subcategories 'animal liver', 'animal kidney', 'animal blood' and 'animal other organs' of level 2.

The intake of processed meat is calculated as the sum of the subcategories 'processed whole meat products', 'preserved fat tissue', 'sausages', 'meat specialities', 'animal meat dried', 'marinated meat', and 'canned-tinned meat' of level 2.

The intake of white meat is calculated as the sum of the subcategory 'rabbit fresh meat' of level 4 and the subcategory 'birds meat' of level 3, both from the subcategory 'mammals and birds meat' of level 2 and the

Note: A0EYE Animal Carcase (L2), A0BY5 Animal Mechanically Separated meat (L2), A020P Animal other slaughtering products(L2), and A0F1J Edible casing (L2) are excluded, because there will be hardly anything classified; and A01TT Animal fresh fat tissue (L2) and A0EYN Preserved fat tissue (L2) are also excluded, because this is fat not meat.

Fish

The intake of fish is calculated as the sum of the subcategories 'fish meat', 'fish offal', 'crustaceans', 'molluscs', 'sea-squirts and other tunicates', 'sea urchins and other echinoderms', 'jellyfishes and similar', and 'fish and seafood processed' of level 2.

Milk and milk products

For the food group 'milk and milk products', a differentiation is made between dairy (including all kind of milk, cream, yoghurt, cheese in its soft versions, but excluding butter and cheese in its hard versions) and cheese (including only the harder versions).

The intake of dairy is calculated as the sum of the subcategories 'milk', 'cream and cream products' and 'buttermilk' of level 3 from the subcategory 'milk, whey and cream' of level 2, the subcategory 'fermented milk or cream' of level 2, the subcategory 'fresh uncured cheese' of level 3 from the subcategory 'cheese' of level 2, and the subcategories 'dairy desserts spoon-able' and 'baked milk and similar' of level 3 from the subcategory 'dairy desserts and similar' of level 2.

The intake of hard cheese is calculated as the sum of the subcategories 'brined cheese', 'ripened cheese' and 'processed cheese and spreads' of level 3 from the subcategory 'cheese' of level 2.

Eggs and egg products

The intake of eggs is derived from the category 'eggs and egg products' of level 1, hereby including all the subcategories of level 2 (i.e. unprocessed eggs and processed eggs).

Fats and oils

A differentiation is made between fats from butter and hard margarines and fats from soft margarine and vegetables oils.

The intake of butter, hard margarines and cooking fat is calculated as the sum of the subcategory ‘other plant oils’ of level 4 and the subcategory ‘fats and oils from terrestrial animals of level 4, ‘processed fat blubber of marine mammals’ of level 5, and the subcategory ‘dairy fats’ of level 3, all belonging to the subcategory ‘animal and vegetable fats/oils of level 2, and the subcategory ‘butter’ of level 3, ‘traditional margarine’ of level 4, and ‘blended fat and oils’ of level 3, all belonging to the subcategory ‘fat emulsions and blended fats’ of level 2.

The intake of soft margarine, liquid cooking fat, vegetable oils is calculated as the sum of the subcategories ‘olive oils’ and ‘seed oils’ of level 4 and the subcategory ‘fish oil’ of level 5, all belonging to the subcategory ‘animal and vegetable fats/oils of level 2, and the subcategory ‘blended margarine’ and ‘functional vegetable margarine/fats’ of level 4, both belonging to the subcategory ‘fat emulsions and blended fats’ of level 2.

Sugar-sweetened beverages

The intake of sugar-sweetened beverages is calculated as the sum of the category ‘fruit and vegetable juices and nectars including concentrates’ of level 1 and the subcategory ‘water-based beverages’ and ‘beverages concentrates’ of level 2 from the category ‘water and water-based beverages’ of level 1.

Alcoholic beverages

The intake of alcoholic beverages is differentiated by the subcategories ‘beer and beer-like’, ‘wine and wine-like’, ‘mixed alcoholic drinks’, and ‘unsweetened spirits and liqueurs’ of level 2 from the category ‘alcoholic beverages’ of level 1 in order to be able to calculate the ethanol intake.

Tea and coffee

The intake of coffee is derived from ‘coffee beverages’ of level 3, and the intake of tea is derived from ‘tea beverages’ of level 3. If reported as water and dry matter, then this was recalculated into beverages (Czech Republic).

Salt

The intake of salt is separately mentioned in level 4 as part of the subcategory on seasonings. This intake of salt covers the salt used for cooking and at the table, but not the salt present in food products (like bread, meat, etc.).

Additional notes:

Denmark:
In Denmark, the dietary data is coded to the ingredient level instead of the food level.

Czech Republic:
In Czech Republic, the consumption data was already coded to the FoodEx2 Exposure Hierarchy of EFSA. Linkage of data according to Appendix IV was in general without problems, however a few modifications were applied:

- The original national coding was not fully compatible with the structure of FoodEx2. It was necessary to use hierarchically higher FoodEx2 codes (not covered by Appendix IV) in some items because of the lack of appropriate more detailed code in FoodEx2. For example local type of cheese was coded in FoodEx2 as A02QE Cheese and we included this product into "Cheese" group. Similar approach was applied also for some other general codes in FCD: game meat, vegetable oil, fruit juices.
- A0F0B Pig head, A021G Pig trotters and feet, A020V Bovine stomach, A021B Pig tongue, A021C Pig heart were consumed and coded in our food consumption data. We have decided to include these codes to the „Meat and meat products" food group even though A020P Animal other slaughtering products were excluded according to Appendix IV.
- Tea and coffee in our FCD were presented as decomposed into water and dry matter. We have recalculated such records back to beverages but values for coffee and tea expressed as dry matter are also added to the food intake file.

Italy:
Differentiation between white grain and whole grain products was rather difficult.

France:
/

APPENDIX V: Reducing consecutive 7-day diet record to two random non-consecutive days

Reducing consecutive 7-day diet record to two random non-consecutive was performed using Random Integer Set Generator with additional settings for the inclusion of only the combinations of two non-consecutive days (Table V.1).

Table V.1. The possible combinations of two non-consecutive days.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Day 1	X	X	✓	✓	✓	✓	✓
Day 2	X	X	X	✓	✓	✓	✓
Day 3	✓	X	X	X	✓	✓	✓
Day 4	✓	✓	X	X	X	✓	✓
Day 5	✓	✓	✓	X	X	X	✓
Day 6	✓	✓	✓	✓	X	X	X
Day 7	✓	✓	✓	✓	✓	X	X

This tables shows that drawing the random sets of the two-day combinations resulted in an over-representation of day 1 and day 7 from the sets (1,7) and (7,1), hence an unbalanced representation of the days included. This issue was disentangled by adding five combinations to the set in double, in particular the factors of the sets (2,4), (3,5), (4,6) and (6,3) were doubled in order to get a balanced representations of the days included (Table V.2). This resulting list of 35 sets is multiplied to a list of 7000 sets with each combination tagged by a random number from the interval [1 – 7000] in order to randomly assign one set of two days to each subject of the dietary survey.

Table V.2 Factors for the different combinations of non-consecutive days.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Column total
Day 1			1	1	1	1	1	5
Day 2				2	1	1	1	5
Day 3	1				2	1	1	5
Day 4	1	1				2	1	5
Day 5	1	2	1				1	5
Day 6	1	1	2	1				5
Day 7	1	1	1	1	1			5
Row total	5	5	5	5	5	5	5	35

APPENDIX VI: Equations for the identification of misreporting.

Underreporting of food intake is a widely-acknowledged issue in dietary assessment methods due to varied reasons (voluntary omission of foods consumed, inaccurate estimation of portion sizes eaten, etc.). This might have a particular impact on the estimates at low percentiles of the intake distribution, resulting in an underestimation of the prevalence of adequate intake. Under-reporting at the individual level is identified by comparing the ratio of energy intake to basal metabolic rate to Goldberg cut-off points(Goldberg, Black et al. 1991). Using the Goldberg cut-off limit to evaluate reported energy intakes at the individual level is based on the comparison between individual energy intake reported : basal metabolic rate estimated and a physical activity level (PAL)-value of 1.55 for light activity. This comparison is based on the assumption that BMR x PAL of 1.55 is likely to represent a probable minimum energy requirements for a normally active individual with a sedentary lifestyle. However, the Goldberg's cut-offs have a moderately low sensitivity in identifying under-reporters, i.e. subjects identified as extreme under-reporters are likely to have truly underestimated energy intake, but a proportion of the subjects identified as normal reporters are likely to be under-reporters (Black 2000). Correcting cut-offs on the basis of physical activity level, as suggested by Black, is therefore likely to improve the identification of under-reporters, when complementary information on individual's physical activity level is available (Goldberg and Black 1998, Black 2000).

The following equations as proposed by Goldberg and Black (Black 2000) were applied to derive cut-offs for evaluating misreporting, of which the first equation refers to the lower cut-off value to identify under-reporters and the second on to the upper cut-off value to identify over-reporters in a defined study population.

$$EIrep: BMRest > PAL \times \exp\left[SDmin \times \frac{S/100}{\sqrt{n}}\right]$$

$$EIrep: BMRest < PAL \times \exp\left[SDmax \times \frac{S/100}{\sqrt{n}}\right]$$

where

EIrep refers to energy intake as reported and is calculated as the average value based on energy intakes reported for each of non-consecutive days of 24-hour recall or diet-record.

BMRest refers to the basal metabolic rate as calculated using equations of Schofield for estimating sex-specific BMR from weight and height.

PAL refers to the physical activity level, which is set at 1.55 for a normally activity, but sedentary lifestyle, because of lack of data on physical activity

SDmin is -2 for the 95% lower confidence limit

SDmax is +2 for the 95% upper confidence limit

S is the factor that represent the variation in energy intake, BMR and PAL, and is calculated with the following formula using the revised factors by Black:

$$S = \sqrt{\frac{CV^2{}_{wEI}}{d} + CV^2{}_{wB} + CV^2{}_{tP}}$$

where

CVwEI is the within-subject variation in energy, i.e. factor 23%.

d is the number of days of diet assessment, i.e. two in the present analysis

CVwB is the within-subject variation in repeated BMR measurements or the precision of estimated BMRest compared with measured BMR, including measurement error and variation with time on repeated BMR measurements, i.e. 8.5%.

CVtP is the total (between-subject) variation in PAL, including within-subject variation and the methodological errors, i.e. factor 15%

- ⇨ Lower 95% confidence limit = 0.96 to identify under-reporters
- ⇨ Upper 95% confidence limit = 2.49 to identify over-reporters

References

Black, A. E. (2000). "Critical evaluation of energy intake using the Goldberg cut-off for energy intake: basal metabolic rate. A practical guide to its calculation, use and limitations." International Journal of Obesity & Related Metabolic Disorders 24(9).

Goldberg, G., A. Black, S. Jebb, T. Cole, P. Murgatroyd, W. Coward and A. Prentice (1991). "Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording." European journal of clinical nutrition 45(12): 569-581.

Goldberg, G. R. and A. E. Black (1998). "Assessment of the validity of reported energy intakes-review and recent developments." Food & Nutrition Research 42: 6-9.