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SCIENTIFIC OPINION

Scientific Opinion on establishing Food-Based Dietary Guidelines[1]

EFSA Panel on Dietetic Products, Nutrition, and Allergies (NDA)[2, 3]

European Food Safety Authority (EFSA), Parma, Italy

ABSTRACT

This Opinion of the EFSA Panel on Dietetic Products, Nutrition, and Allergies (NDA) provides guidance on the translation of nutrient based dietary advice into guidance, intended for the European population as a whole, on the contribution of different foods or food groups to an overall diet that would help to maintain good health through optimal nutrition (food-based dietary guidelines). The main focus of this Opinion is put on the scientific process of developing food-based dietary guidelines (FBDG) for the diverse European populations, following a stepwise approach which should ideally consist of: 1) Identification of diet-health relationships, 2) Identification of country specific diet-related health problems, 3) Identification of nutrients of public health importance, 4) Identification of foods relevant for FBDG, 5) Identification of food consumption patterns, 6) Testing and optimising FBDG and 7) Graphical representations of FBDG. FBDG should focus on the diet-disease relationships of particular relevance to the specific population and should be developed using a multi-disciplinary approach. The early involvement of stakeholders is recommended to promote the acceptance of the outcome. FBDG should be consistent with other public policies that have an impact on food availability and be integrated with other policies related to health promotion. Once established, FBDG should be implemented and their impact monitored and evaluated.

KEY WORDS

Food-based dietary guidelines, foods, nutrients, health relationship, food consumption pattern, food policy

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SUMMARY

The European Commission requested the European Food Safety Authority (EFSA) to provide guidance on the translation of nutrient based dietary advice into guidance, intended for the European population as a whole, on the contribution of different foods or food groups to an overall diet that would help to maintain good health through optimal nutrition (food-based dietary guidelines).

In preparing its scientific advice to the Commission, the EFSA Scientific Panel on Dietetic Products, Nutrition and Allergies (NDA) reviewed the reasons and general principles for food-based dietary guidelines (FBDG), identified relevant scientific information for establishing FBDG for individual countries within the EU and summarised steps for implementation, monitoring and evaluation for individual countries. Recent reviews and papers on food-based dietary guidelines, on Dietary Reference Values and available information on diet-related health problems and dietary patterns in Europe were taken into account. The Panel also used a questionnaire to gather information on already existing food-based dietary guidelines in a number of EU Member States.

Food-based dietary guidelines constitute science-based policy recommendations in the form of guidelines for healthy eating. They are primarily intended for consumer information and education, and as such, they should be appropriate for the region or country, culturally acceptable and practical to implement. Moreover, they should be consistent, easily understood and easily memorable.

The development of food-based dietary guidelines consists of the integration of scientific knowledge about nutrients, foods and health in order to identify dietary patterns that facilitate the achievement of desirable food and nutrient intakes.

Food-based dietary guidelines should focus on the diet-disease relationships of particular relevance to the specific population. In most EU Member States, overweight and obesity, cardiovascular diseases, cancer, hypertension, dyslipidaemia, type 2 diabetes, and osteoporosis can be identified as important diet-related public health issues. However, the prevalence of these conditions varies considerably between countries. A number of nutrients of public health importance for EU populations have been identified, i.e. nutrients for which there is evidence of dietary imbalance that might influence the development of these conditions. These include nutrients that might be consumed to excess, e.g. energy, total fat, saturated and *trans* fatty acids, sugars and salt, as well as those for which intake might be inadequate, e.g. unsaturated fatty acids, dietary fibre, water, as well as some vitamins and minerals (such as vitamin D, folate, potassium, calcium, iron, iodine). The occurrence of such nutrient imbalances varies between countries. The differences between EU countries in the prevalence of nutrient imbalances and diet-related public health issues, together with the considerable disparities across countries in dietary habits and traditions, require that food-based dietary guidelines be established by country or region.

The development of food-based dietary guidelines may be carried out using a stepwise approach:

- *Identification of diet-health relationships* - Evidence on diet-health relationships is available from reviews that are carried out regularly by national and international agencies;
- *Identification of country specific diet-related health problems* - Specific diet-related health patterns, disease and mortality rates, should be reviewed to identify and prioritise nutrition problems of public health significance;
- *Identification of nutrients of public health importance* - Nutrient imbalances in the population (groups) should be identified by comparing habitual intake from dietary surveys to Dietary Reference Values, and by using anthropometric and available biochemical indicators of nutritional status;

- *Identification of foods relevant for food-based dietary guidelines* - Food groups that are sources of nutrients of public health importance and foods for which intakes explain differences between groups who do and do not achieve target nutrient recommendations should be identified from observed patterns of dietary intake. Intake of food groups with established relationships to health (e.g. fruit and vegetables) should also be estimated;

- *Identification of food consumption patterns* - Food consumption patterns in the population that are consistent with the achievement of recommended intakes of nutrients should be identified. In addition, it is important to identify population characteristics for each pattern. Recommendations for food-based dietary guidelines should be made taking into account specific needs of population groups;

- *Testing and optimising food-based dietary guidelines* - The coherence and effectiveness of food-based dietary guidelines in meeting nutrient recommendations should be confirmed by modelling of food and nutrient intake data and the food-based dietary guidelines should be adapted appropriately;

- *Graphical representations of food-based dietary guidelines* - Graphical representations of food-based dietary guidelines may be developed in order to facilitate communication to consumers.

To be successful, the process of developing and implementing food-based dietary guidelines should be conducted using a multi-disciplinary approach. The early involvement of stakeholders is recommended to promote the acceptance of the outcome.

It is recommended that food-based dietary guidelines should be consistent with other public policies that have an impact on food availability and be integrated with other policies related to health promotion.

Once established, food-based dietary guidelines should be implemented and their impact monitored and evaluated.

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BACKGROUND AS PROVIDED BY THE EUROPEAN COMMISSION

The scientific advice on nutrient intakes is important as the basis of Community action in the field of nutrition, for example such advice has in the past been used as the basis of nutrition labelling. The Scientific Committee for Food (SCF) report on nutrient and energy intakes for the European Community dates from 1993. There is a need to review and if necessary to update these earlier recommendations to ensure that the Community action in the area of nutrition is underpinned by the latest scientific advice.

In 1993, the SCF adopted an opinion on the nutrient and energy intakes for the European Community[4]. The report provided reference intakes for energy, certain macronutrients and micronutrients, but it did not include certain substances of physiological importance, for example dietary fibre.

Since then new scientific data have become available for some of the nutrients, and scientific advisory bodies in many European Union Member States and in the United States have reported on recommended dietary intakes. For a number of nutrients these newly established (national) recommendations differ from the reference intakes in the SCF (1993) report. Although there is considerable consensus between these newly derived (national) recommendations, differing opinions remain on some of the recommendations. Therefore, there is a need to review the existing EU reference intakes in the light of new scientific evidence, and taking into account the more recently reported national recommendations. There is also a need to include dietary components that were not covered in the SCF opinion of 1993, such as dietary fibre, and to consider whether it might be appropriate to establish reference intakes for other (essential) substances with a physiological effect.

In this context the EFSA is requested to consider the existing population reference intakes for energy, micro- and macronutrients and certain other dietary components, to review and complete the SCF recommendations, in the light of new evidence, and in addition advise on a population reference intake for dietary fibre.

For communication of nutrition and healthy eating messages to the public it is generally more appropriate to express recommendations for the intake of individual nutrients or substances in food-based terms. In this context the EFSA is asked to provide assistance on the translation of nutrient based recommendations for a healthy diet into food based recommendations intended for the population as a whole.

TERMS OF REFERENCE AS PROVIDED BY EUROPEAN COMMISSION

In accordance with Article 29 (1)(a) and Article 31 of Regulation (EC) No. 178/2002, the Commission requests EFSA to review the existing advice of the Scientific Committee for Food on population reference intakes for energy, nutrients and other substances with a nutritional or physiological effect in the context of a balanced diet which, when part of an overall healthy lifestyle, contribute to good health through optimal nutrition.

In the first instance the EFSA is asked to provide advice on energy, macronutrients and dietary fibre. Specifically advice is requested on the following dietary components:

- Carbohydrates, including sugars;
- Fats, including saturated fatty acids, poly-unsaturated fatty acids and mono-unsaturated fatty acids, *trans* fatty acids;

[4] Scientific Committee for Food, Nutrient and energy intakes for the European Community, Reports of the Scientific Committee for Food 31st series, Office for Official Publication of the European Communities, Luxembourg, 1993.

- Protein;
- Dietary fibre.

Following on from the first part of the task, the EFSA is asked to advise on population reference intakes of micronutrients in the diet and, if considered appropriate, other essential substances with a nutritional or physiological effect in the context of a balanced diet which, when part of an overall healthy lifestyle, contribute to good health through optimal nutrition.

Finally, the EFSA is asked to provide guidance on the translation of nutrient based dietary advice into guidance, intended for the European population as a whole, on the contribution of different foods or categories of foods to an overall diet that would help to maintain good health through optimal nutrition (food-based dietary guidelines).

ASSESSMENT

A draft of this Opinion, agreed by the NDA Panel on 2 July 2008, was published on the EFSA website[5] for public consultation between 8 August and 15 December 2008. The draft Opinion was also discussed at a National Expert Meeting with Member States on Dietary Reference Values held in Barcelona on 7 and 8 September 2009. All the public comments received and comments from Member States that related to the remit of EFSA were assessed and the Opinion has been revised taking relevant comments into consideration. The comments received, a report on the outcome of the public consultation, and the minutes of the meeting with Member States have been published on the EFSA website.

1. Introduction

Poor diet and a sedentary lifestyle account for a major part of the morbidity and mortality that exist throughout the world. The International Conference on Nutrition (ICN) organised by the United Nations Food and Agricultural Organisation (FAO) and the World Health Organization (WHO) in 1992, identified and encouraged strategies to improve nutritional well-being and food consumption throughout the world. The plan of action, adopted by the ICN, includes among its strategies "promoting appropriate diets and healthy lifestyles" and calls upon governments "on the basis of energy and nutrient recommendations, to provide advice to the public by disseminating, through the use of mass media and other appropriate means, qualitative and/or quantitative dietary guidelines relevant for different age groups and lifestyles and appropriate for the country's population" (FAO/WHO, 1992).

In pursuance of these goals and strategies, in 1995 WHO and FAO jointly convened an Expert Consultation on the "preparation and use of food-based dietary guidelines" where recommendations for the development and use of food-based dietary guidelines (FBDG) were formulated and discussed. According to this consultation, FBDG should be based on current dietary practices and prevailing public health problems, rather than on nutrient requirements and recommended intake levels alone. Such guidelines represent the form in which advice is provided to people to assist them in selecting a diet to meet their needs for health (WHO/FAO, 1998).

FBDG are described by the WHO as "the expression of the principles of nutrition education mostly as foods". Since FBDG are intended to provide nutrition education and dietary guidance for individual members of the general public, they need to be formulated in such a way as to make them a truly practical means of assisting people to reach appropriate nutritional goals. Where they cannot be expressed as foods they have to be written in ordinary language, avoiding as far as possible the technical terms of nutritional science (WHO/FAO, 1998). Presently, a number of countries in and outside Europe have developed FBDG (e.g. HHS/USDA, 2005; Enghardt Barbieri and Lindvall, 2005; OptimiX, 2005; WHO, 2003a).

According to the request of the Commission, EFSA is evaluating the 1993 SCF opinion on (formerly) Population Reference Intakes for nutrients and certain other dietary components. New opinions on Dietary Reference Values (DRVs) are being established. DRVs are quantitative reference values for nutrient intakes for healthy individuals and populations which may be used for assessment and planning of diets. Some of the DRVs relate to nutrient requirements that are defined by specific criteria of nutrient adequacy. For some nutrients, nutrient based dietary guidelines are given instead of DRVs. Nutrient based dietary guidelines differ from DRVs in that the advice is more provisional and is based on a variety of information, including indirect evidence about the complex relationships between food components, health and disease (WHO/FAO, 1998), and are not within the remit of the EFSA's task. As people think of and eat food rather than its components, nutrient based recommendations need to be

[5] http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1211902045161.htm

translated into FBDG to be accepted by the population. The present Opinion aims to give guidance on the process of developing FBDG for the European population.

The Panel adopted the following approach:

- to review the reasons and general principles for FBDG (section 2 and 3);
- to identify relevant scientific information for establishing FBDG for individual countries within the EU (section 4);
- to summarise steps suggested for implementation, monitoring and evaluation for individual countries (section 5).

For this purpose the Panel has considered:

- recent reviews and papers on FBDG (WHO/FAO, 1998; Williams et al., 1999; Eurodiet, 2000; Ferro Luzzi et al., 2001; Kafatos et al., 2001; ILSI, 2004; King, 2007; Walter and Elmadfa, 2007);
- recent reviews and reports prepared by EFSA (2006a), the Institute of Medicine (IoM, 1997; 1998; 2000; 2002; 2003a; 2003b; 2004; 2005), WHO (1998; 2003a); USDA (HHS/USDA, 2005) and available information on diet-related health problems and dietary patterns in Europe (Eurodiet, 2000; WHO/FAO, 2003; 2006; WCRF and AICR, 2007);
- the results of a recent scientific colloquium, discussing the state-of-the-art of scientific approaches and the advantages and limitations of various approaches for the development of FBDG (EFSA, 2006b);
- information from questionnaires on existing FBDG in EU countries. To get information on already existing FBDG, Network Members of EFSA's Data Collection and Exposure Unit or experts of the EFSA Working Group on Population Reference Intake (PRI) were asked to provide names and affiliation of persons in charge of developing FBDG in their country. A computerised questionnaire was sent by EFSA to the competent person identified in 20 of 25 EU countries. Questions were related to the presence of FBDG, origin, target groups, information used in setting FBDG, and other issues as selected food groups, other health related messages, way of presentation etc (see section 6 and annex 1).

2. Rationale for FBDG

In all European countries, there are public health issues related to diet and some unfavourable trends in food consumption patterns. Benefits could be expected from the improvement of food consumption patterns for well-being, long-term health of individuals and populations and thus for health costs savings. FBDG is one of the tools used to help reach these goals.

Reasons for developing and using FBDG, in addition to the development of dietary reference values for nutrients, include (WHO/FAO, 1998):

- Foods make up diets; foods are more than just collections of nutrients;
- Nutrients interact differently, depending on the food matrix;
- Methods of food processing, preparation and cooking influence the nutritional value of foods;
- Specific dietary patterns are associated with reduced risk of specific diseases; the protective effect could be due to a single nutrient, a combination of foods or non-nutrients, or the replacements of some other foods in the diet;
- Some food components may have beneficial biological functions but the exact mechanisms and compounds have not been completely identified;

- Foods and diets have cultural, ethnic, social and family aspects that individual nutrients themselves do not have.

FBDG are primarily intended for consumer information and education, but their effectiveness would require that they should be also taken into account by policymakers, healthcare providers, nutritionists, and nutrition educators in designing and implementing nutrition-related programmes, nutrition education, and information programmes to help consumers in planning an overall healthful diet. As such, FBDG should be an essential component of diet-related health policies.

3. General principles for establishing FBDG

FBDG constitute science-based policy recommendations in the form of guidelines for healthy eating. The development of FBDG consists of the integration of knowledge regarding individual nutrients, food components and foods into guidelines for a pattern of eating.

FBDG need to be based on sound scientific principles. Epidemiological and experimental research provides evidence that specific diseases and conditions linked to poor diet include cardiovascular disease, hypertension, dyslipidaemia, type 2 diabetes, overweight and obesity, osteoporosis, constipation, diverticular disease, iron deficiency anaemia, dental caries and malnutrition.

Food consumption patterns vary across Europe. As an example, figures 1 and 2 illustrate differences between the availability of ten major food groups in Portugal and France and the average availability for consumption in Western countries in 1992 (http://museum.agropolis.fr:80/pages/expos/banquet/modele.htm).

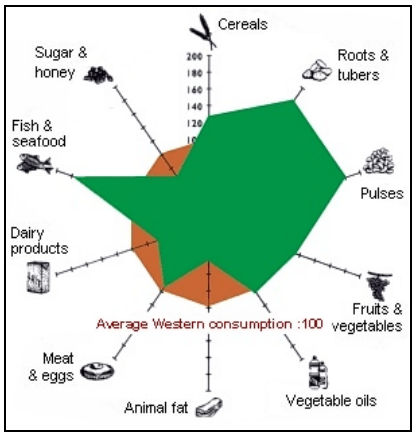

Figure 1: The Portuguese food pattern.[1]

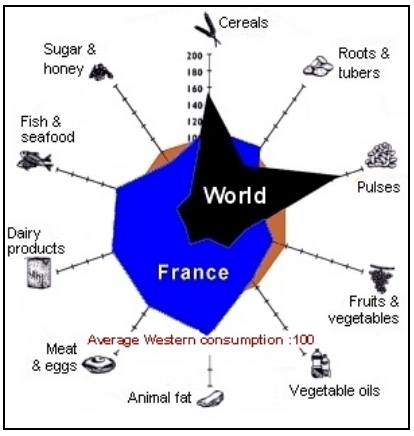

Figure 2: The French food consumption pattern.[1]

[1] Average availability of various food groups by country are expressed as the deviation (%) from the overall availability; the circle corresponds with the average availability in Western countries (=100%).

The Portuguese food consumption pattern is characterised by a high availability of plant foods and fish and a relatively low availability of animal fat and animal food products. The French pattern is characterised by a high availability of animal products. Recently, Slimani et al. (2002) described the diversity in dietary patterns existing across centres/regions participating in the European Prospective Investigation into Cancer and Nutrition (EPIC), based on 24-hour dietary recalls among nearly 36,000 men and women, aged 35 to 74 years.

Although there is a trend to a general convergence of European diets and lifestyles there are still important differences between Member States of the EU (WHO/FAO, 2003). In addition, depending on many factors including dietary habits, diet-related health issues also vary across Europe, though the hierarchy of the disease burden is more comparable. Thus, FBDG have to be based directly upon the diet and disease relationships that are particularly important to the individual country. The development

of European FBDG has been proposed in the Countrywide Integrated Non-communicable Disease Intervention (CINDI) Project (WHO, 2000; 2003a). These FBDG would be very general, only related to a number of basic food groups and, as emphasised by WHO, should be tailored to the country-specific situation, culture and habits, to enhance their effectiveness (WHO, 2003a).

The scientific process underpinning the development of FBDG should follow the generally accepted rules of scientific excellence, transparency and independence, in order to merit the confidence of consumers in the final result.

The initial design and final formulation of FBDG, as well as their implementation should involve all stakeholders (from consumer organisations to industry organisations, including representatives of different public authorities responsible for areas such as agriculture, health, industry) and scientists. The early involvement of stakeholders in the process would enhance the openness and transparency and would favour the acceptance and effectiveness of the final result.

Once established and implemented, the impact of FBDG should be monitored and evaluated. In this evaluation, cost effectiveness of the actions based on FBDG (Brunner et al., 2001) but also consumer behaviour should be carefully analysed.

In addition, to make FBDG meaningful to the general public, they should relate to the social, economic, agricultural and environmental factors affecting food availability and eating patterns for the given country or region, be practical to implement and should recognise that health relates to more than one dietary pattern (WHO/FAO, 1998).

Moreover, FBDG should be comprehensible, short, simple, clear and easily memorable. In the implementation stage, attention should be given to the translation into messages and slogans, and to communicating FBDG information effectively to the public. Bodies responsible for developing FBDG are encouraged to integrate the FBDG-messages with other policies related to health promotion.

4. Scientific process in setting FBDG

In the process of developing FBDG, the following steps, adapted and extended from previous reports (WHO/FAO, 1998; HHS/USDA, 2005; Enghardt Barbieri and Lindvall, 2005; Optimi*X*, 2005), may be considered. These steps follow a logical order, although they can be also iterative, moving back and forth between the different steps. Ideally, all these steps should be followed in order to establish appropriate country-specific guidelines. However, depending on human and financial resources as well as availability and nature of country or even region-specific data, the implementation of all these steps is not necessarily required to develop country specific FDBG, and this will be underlined in the corresponding sections.

4.1. Identification of diet-health relationships

There is evidence that, for a number of nutrients and food groups, a dietary imbalance can increase the risk of obesity and diet-related diseases (e.g. cardiovascular disease, cancer, diabetes mellitus, osteoporosis and dental disease) that are of importance for public health in the EU.

For example, in 2003, the WHO/FAO published a report which includes a summary of current scientific knowledge concerning the relationships between dietary factors and the most common diet-related chronic diseases worldwide (WHO/FAO, 2003). The WHO/FAO expert consultation has classified the strength of evidence of these relationships as convincing evidence, probable evidence, possible evidence and insufficient evidence.

The evidence on diet-health relationships is regularly reviewed and weighed at an international level using highly qualified international collective expertise. The resulting reports can be conveniently used

at a country level, avoiding duplication of effort (e.g. WHO, WCRF and AICR, IOTF, EFSA). National reports from other countries including such reviews can also be used, where appropriate (e.g. IoM). All these reports provide relevant and recent information that can be sufficient in many cases to move to the next steps. Some specific health issues are not always taken into account in general reports addressing major and worldwide health issues such as cancer, cardiovascular diseases or obesity and completion of these existing reviews could be required to address specific diet-health relationships for some countries.

The public health importance of many nutrients and foods for European populations has also been identified in science based nutrient intake recommendations and FBDG from national and international agencies (e.g. NNR, 2004; GR, 2006; Eurodiet, 2000; WHO, 2006). For a number of nutrients and foods (total fat, saturated, unsaturated and *trans* fatty acids, protein, carbohydrates, sugars, dietary fibre, salt, fruit and vegetables), population intake goals that have been established in a number of Member States are generally consistent (but not uniform), and aimed at the prevention of major diet-related public health problems in Europe. A summary of the health relationships for a number of nutrients and foods is presented below. As underlined in the following section (4.3), this information is relevant for European countries and could form the starting point to establish FBDG.

Energy balance **-** The main sources of energy in food are carbohydrates and fats, with a small contribution made by proteins and possibly by alcohol. In healthy people, the energy intake should be in balance with energy expenditure. The energy density of foods and diets varies depending on the water content and on the concentration of different macronutrients and dietary fibre. Consuming diets of high energy density can undermine normal appetite regulation leading to increased overall energy intake through "passive over-consumption" of food and can lead to weight gain, particularly in subjects with a sedentary lifestyle (WHO/FAO, 2003; IoM, 2005).

Total fat - Diets high in fat generally have a high energy density, can contribute to excessive energy intake and energy imbalance and thus might promote weight gain. However, no causal relationship has been established between total fat intake and obesity or chronic disease risk (IoM, 2005).

Fatty acid pattern **-** Diets high in saturated fatty acids (SFA) increase serum LDL-cholesterol and diets high in *trans* fatty acids (TFA) increase LDL-cholesterol, reduce HDL-cholesterol and increase the total cholesterol to HDL-cholesterol ratio, all of which have been associated with an increased risk of cardiovascular diseases. In contrast, diets high in mono- and poly-unsaturated fatty acids (MUFA and PUFA, respectively) and long chain omega-3 PUFA (n-3 LCPUFA) from fish and fish oils (eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) may reduce the risk of cardiovascular disease (IoM, 2005; EFSA, 2004; EFSA, 2005a).

Fruit and vegetables **-** Numerous ecological and prospective studies have shown a significant association of a high consumption of fruit and vegetables with a decrease in the risk of obesity, coronary heart disease and stroke (Eurodiet, 2000; WHO/FAO, 2003). Fruit and vegetables are important low-energy density foods and at the same time important sources of dietary fibre, minerals (potassium and magnesium) and vitamins (vitamin C, folate).

Dietary fibre **-** High dietary fibre consumption is related to optimal bowel function and reduction of cardiovascular disease risk. An adequate dietary fibre intake is also associated with weight maintenance and sustained weight reduction in overweight subjects, because of its satiating effect (WHO/FAO, 2003; van Dam and Seidell, 2007; IoM, 2005).

Sugars **-** Increased risk of dental caries in children is associated with frequent consumption (more than about four times daily) of cariogenic sugars (mainly sucrose, glucose, and fructose) rather than with the total amount of dietary sugars; the evidence indicates that frequent consumption of sweets and confectionery products and sugar-containing drinks increases caries risk (Moynihan and Petersen, 2004; DoH, 1991; IoM, 2005) especially when prophylactic measures, e.g. oral hygiene and fluoride

prophylaxis, are insufficient. The evidence relating high intake of sugars (mainly as added sugars), compared to high intakes of starch, to weight gain is inconsistent (IoM, 2005; van Dam and Seidell, 2007). However, there is some evidence that sugar-sweetened beverages do not induce satiety to the same extent as solid forms of carbohydrate, and that high intakes of sugars in the form of sugar-sweetened beverages contribute to weight gain (van Dam and Seidell, 2007; Mann et al., 2007). Although there is some evidence that high intakes of added sugars, particularly from low nutrient density foods, may be associated with a decrease in the nutrient density of the diet due to displacement of nutrient rich foods (van Dam and Seidell, 2007), a systematic review concluded that the evidence for an association of micronutrient dilution with added sugar intake is limited and inconsistent (Rennie and Livingstone, 2007).

Vitamins and minerals **-** For men and women older than 50 to 60 years there is convincing evidence that a sufficient intake of calcium and vitamin D together reduces the risk of osteoporosis (WHO/FAO, 2003). Adequate dietary intake of potassium helps to maintain lower blood pressure levels and to reduce the adverse effects of high sodium intake on blood pressure; fruit and vegetables are important sources of potassium (IoM, 2004; WHO/FAO, 2003). The major adverse effect of high dietary sodium intake is elevated blood pressure; high blood pressure is an acknowledged risk factor for ischaemic heart disease, stroke and renal disease (IoM, 2004; EFSA, 2005b). Iron deficiency anaemia has detrimental health implications, particularly for mothers and young children and there is evidence of low intake and status for iron in young children and in women of child-bearing age in some EU countries (Elmadfa, 2009; WHO, 2002). Low maternal folate intake in early pregnancy is a causal factor for neural tube defects in infants and many EU countries recommend that women planning a pregnancy should supplement their diet with 400µg/day of folic acid (SACN, 2006). Iodine deficiency, of mild to moderate severity, which is an important determinant of foetal and child development, is recognised in a number of EU Member States. National salt iodisation programmes have been implemented in some EU countries to address this problem (WHO, 2002).

Alcohol **-** High alcohol intakes are associated with an increased morbidity and mortality (Murray and Lopez 1996). On the other hand, there is some evidence that low to moderate alcohol consumption lowers the risk of coronary heart disease compared with abstainers (Foster and Marriot, 2006).

Water **–** Water is essential for practically all functions of the body and is particularly important for thermoregulation. A water intake which balances losses and thereby assures adequate hydration of body tissues is essential for health and life. Water is consumed from different sources, which include drinking water, beverages, moisture content of foods (EFSA, 2008b). The choice of beverages can have an influence on energy balance and nutrient intake.

In setting FBDG for individual countries it is important:

- *to collect all recent international and national expert reviews on diet-health relationships ;*
- *to complete the review if additional country-specific health and dietary issues have to be considered.*

4.2. Identification of country-specific diet-related health problems

This step aims to identify country-specific diet-related health issues and helps to rank the different problems according to importance. Analysis of country-specific health statistics forms the basis of this step. A comparison with statistics of other Member States is a valuable help in identifying the health issues which could be improved by implementation of FBDG.

Analyses suggest that poor nutrition accounts for 4.6% of the total disability-adjusted life-years lost in the EU, with obesity and physical inactivity accounting for an additional 3.7% and 1.4%, respectively (WHO/FAO, 2003). In a WHO report the quantitative contribution of dietary risk factors in the WHO European Region to the burden of disease was estimated. Hypertension, high serum cholesterol levels, obesity and low intake of vegetables and fruit, along with smoking contributed to the top 5 most important risk factors (WHO/FAO, 2003).

In most European countries, cardiovascular diseases contribute about 40% to all cause mortality. Within this category of diseases coronary heart disease and stroke are the most important ones. Coronary heart disease contributes about 50% to total cardiovascular diseases and stroke about 25%. Cardiovascular mortality patterns show a clear West-East gradient in both men and women with the highest mortality rates in Eastern Europe. On the other hand, the lowest stroke rates were observed in northern and western European countries, e.g. Sweden, Denmark, The Netherlands and Germany (Kromhout, 2001).

In Europe, the prevalence of obesity and type 2 diabetes is rising. Evidence from population surveys suggest that obesity levels in the EU have risen by between 10-40% over the past decade and current data suggest that the range of obesity prevalence in EU countries is from 10% to 27% in men and up to 38% in women. In some EU countries more than half of the population is overweight. In Finland, Germany, Greece, Cyprus, the Czech Republic, Slovakia and Malta the combination of reported overweight and obesity exceeds the 67% prevalence (IOTF, 2005). Furthermore, the prevalence of overweight and obesity among children is rising significantly. Surveys show overweight and obesity levels among children in Southern Europe to be higher than in Northern European countries. In Malta, Crete, Spain, Portugal and Italy overweight and obesity levels exceed 30% in children aged 7-11. The rates of the increase in childhood overweight and obesity vary, with England and Poland showing the steepest increase (IOTF, 2005). The major problem associated with childhood and adolescent obesity is its possible persistence into adult life, its association with increasing cardiovascular disease and diabetes risk in later life and with premature death (Nicklas et al., 2002; Maffeis and Tato, 2001).

In order to obtain the most precise picture, it is necessary to distinguish age/gender groups and specific population groups that are affected by the different problems.

In setting FBDG for individual countries it is important:

- *to review the specific diet-related health patterns, diseases and mortality in this area;*
- *to identify the nutrition problems of public health significance ;*
- *to try to rank the different problems according to their potential impact on health.*

4.3. Identification of nutrients of public health importance

These are nutrients for which there is evidence of a dietary imbalance in the population that might influence the development of overweight and obesity or diet-related diseases such as cardiovascular disease or other disorders; they include nutrients that might be consumed to excess, e.g. energy, total fat, saturated and *trans* fatty acids, sugars and salt, as well as those for which intake might be inadequate, e.g. unsaturated fatty acids, dietary fibre, as well as some vitamins and minerals (such as vitamin D, folate, potassium, calcium, iron, iodine) (EFSA, 2008a).

Representative and country-specific epidemiological studies on health and diet relationships are not always available. Dietary Reference Values (DRVs) for nutrients nowadays generally take into account long-term effects of nutrient intake levels on health outcomes. Therefore, the comparison of intakes with DRVs can be used as a surrogate. This comparison gives some information about nutrient adequacy in the general population and/or in subgroups (EFSA, 2008a). This is an important step to identify critical nutrients in diet-related health problems, i.e. the nutrients whose intakes are excessive or inadequate as compared to DRVs. Careful check of underreporting and food composition issues is important in order to arrive at sound conclusions.

In addition, anthropometry and appropriate biochemical markers of nutrient adequacy can be used, where available.

Since health related dietary effects do not rely only on the intake of nutrients, but also on the consumption of specific foods, critical foods are analysed in section 4.4.

In evaluating nutritional adequacy of diets, the levels of intakes obtained from food consumption data are compared to DRVs (e.g. Average Requirements (AR), Adequate Intakes (AI), Reference Intake ranges (RI) and/or dietary guidelines). Nutrient imbalances identified by such evaluation may be characterised in different ways, e.g. as mean intakes, as intake distributions, as prevalence of inadequate/excessive intake. A recent example for a visualisation of the nutritional adequacy of diets was developed by the National Institute of Public Health and the Environment in the Netherlands (Wilson-van den Hooven et al., 2008). Such characterisations may be used by policy makers as a basis to set desirable and attainable nutrient intake targets to be achieved at a population level for the general population or specific groups (e.g. children, pregnant women, elderly) that can be used to guide the development of FBDG. Possible targets might be a specified (high) level of compliance with specific nutrient intake recommendations or achievement of a specified population mean intake for a nutrient. These targets would also provide a basis for monitoring the effectiveness of FBDG.

Food consumption data may be collected at the national, household or individual level. The latter type is most relevant for assessing dietary adequacy. According to WHO (2006), data on individual dietary intakes are available in nearly all European countries. Twenty-four Member States indicated that they have collected individual dietary intake data among adults; about 21 countries undertook surveys for adolescents and school children and about 17 and 11 countries for elderly people and pre-school children, respectively. The methods used for estimating dietary intakes varied between the Member States and even within countries. Food Frequency Questionnaires (FFQ) and 24-hour recalls were used most frequently for adults, followed by two- or seven-day dietary records. Several countries also rely on Household Budget Survey (HBS) data. Twenty-nine European countries being either EU Member States or EU candidate countries provided information to WHO on macronutrient intake. The data indicated that total fat and SFA are consumed in excess of recommendations in most European countries. In 93% of the countries average intake of total fat was above 30% of energy intake (E%), with the highest intake in Latvia, Lithuania and Slovenia (~41-45 E%). Only in Italy the intake of SFA was below 10 E%.

In most countries, carbohydrate intake varied between 39 and 49 E%. Only in Portugal, Slovakia (females) and Finland (females) the carbohydrate intake was 50 E% or more. Protein intake ranged from 11 to 16 E%. As a whole, females tended to have lower fat and higher carbohydrate intakes (E%) than males (WHO, 2006).

Some EU countries reported deficiencies of iron and vitamin A. Western European countries also reported iron deficiency anaemia. Iodine deficiency disorders appeared to be a problem in several countries, but not all use universal salt iodisation; most countries iodise household salt only (WHO, 2006).

These findings are in agreement with data on energy and nutrient intake in the European Union, reported by Elmadfa (2009). These authors also mentioned a generally inadequate intake of some vitamins (especially vitamin D and folate) and of calcium in some countries, and a too high intake of sodium.

In setting FBDG for individual countries or regions it is therefore important:

- *to identify nutrients of public health importance for the population (group) in that specific country or region by comparing habitual intake from dietary surveys to the DRVs;*
- *to identify nutrients of public health importance for the population (group) in that specific country or region by using anthropometric and biochemical indicators;*
- *to prioritise those nutrients consumed at levels not in accordance with DRVs and for which there is evidence of an important health relationship in that specific country or region.*

4.4. Identification of foods relevant for FBDG

The aim of this step is to identify foods that: i) are the main vehicles for nutrients of public health importance or ii) have established relationships to health. A major impact on health outcomes and nutrient intakes would be expected from modifications of the level of consumption of these foods. In some cases the nutritional and health benefits associated with a food (e.g. fish) or a food constituent (e.g. folic acid) for the general population might be associated with potential health risks for specific groups of the population. In such situation a country-specific benefit-risk analysis for consumption by vulnerable population subgroups is needed (IoM, 2006; EFSA, 2007).

4.4.1. Food groups that are sources of nutrients of public health importance

As shown in section 4.3 in several European countries the intake of energy, total fat, saturated and *trans* fatty acids, sugars and salt might be consumed in excess, whereas the intake of unsaturated fatty acids, dietary fibre, as well as of certain vitamins and minerals might be lower than recommended in some countries. Therefore, in setting FBDG it is important to focus on foods providing nutrients that should be limited or increased in a healthy diet. Fat intake is used as an example as it is of concern for most European countries.

By calculating the contribution of foods and food groups (including food supplements and fortified foods) to the intake of nutrients, the main contributors to the intake of critical nutrients can be distinguished. Table 1 shows for instance that in the 2001 diet of adults in the UK meat and meat products, cereals and cereal products (including biscuits/cakes/pastries), milk and milk products (including cheese), butter and fat spreads and potato and savoury snacks were the main sources of total fat, together contributing 78% of total fat, 82% of SFA and 87% of *trans* fatty acid intake (Henderson et al., 2002).

Table 1: Percentage contribution of food groups to average daily fat (total fat, saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA) and *trans* fatty acids (TFA)) intake by adults in the UK (source: Henderson et al., 2002).

Type of food	Total fat %	SFA %	MUFA %	n-3 PUFA %	n-6 PUFA %	TFA %
Meat & meat products	23	22	27	17	18	21
Cereals & cereal products	19	18	17	17	20	26
of which : pizza	2	2	2	2	2	1
white bread	2	1	2	3	4	1
biscuits/buns/cakes/ pastries	7	8	7	2	5	17
Milk & milk products	14	24	10	4	3	16
of which: cheese	6	10	4	2		8
Butter & spreading fats	12	11	11	7	14	18
Potato & savoury snacks	10	7	12	17	13	6
of which: chips	5	3	6	12	7	4
savoury snacks	3	3	4	1	3	1
Eggs & egg dishes	4	3	5	2	4	3
Vegetables (excluding potatoes)	4	2	4	11	9	1
Fish & fish dishes	3	2	4	14	4	3
Sugar preserves & confectionery	3	5	3	1	1	4
Fruit & nuts	2	1	3	4	3	0
Others	6	5	4	6	11	2

In the diet of Irish adults, meat and meat products, butter/spreading fats and oils, biscuits/cakes/pastries, and milk/yoghurt were the four main sources, together contributing 58% of total fat intake

(www.iuna.net). In France, fat came mainly from butter, cheese, meat products, oils and biscuits/cakes/pastry (Volatier and Verger, 1999). In the Netherlands, meat and meat products (20%), spreading fats and oils (19%), milk and milk products, including cheese (19%) and biscuits/cakes/pastry (8%) were the main sources of total fat in the diet of young adults. Together these sources also accounted for three fourths of the intake of SFA, 58% of unsaturated fatty acids and 62% of *trans* fatty acids (Hulshof et al., 2004).

Analysis at the level of the whole population provides average consumption levels, mixing consumers and non-consumers of specific foods or food groups. It is useful in this step to study the specific contributions of some food groups only in consumers of the foods of these groups. From the different examples given, it could appear that cheese is a relatively low contributor as compared to other groups; however, for cheese consumers alone, the situation could be somewhat different and cheese might represent a major contributor, suggesting that specific messages for consumers could be envisaged.

To decrease fat intake in the population, it is helpful to identify those foods which best discriminate those people who have a level of fat intake in compliance with recommendations from those who have not by studying the data in more detail.

Data of the national food consumption survey in Ireland also showed that the food groups of cereal and dairy products together make important contributions to energy, macronutrient and micronutrient intakes in adults (Burke et al., 2005). Cereal products were important sources for the mean intake of energy (26%), protein (21%), fat (13%), carbohydrate (41%), dietary fibre (45%), iron (43%) and folate (27%). Dairy products contributed largely to the mean daily intakes of energy (11%), protein (14%), fat (17%), calcium (48%), phosphorus (24%) and vitamin A (27%). Comparable studies in UK (Henderson et al., 2002) and Italy (Turrini et al., 2001) revealed similar conclusions regarding their quantitative importance in the diet. Burke et al. (2005) studied the role of these products in depth by examining the quality of the diet in those who are high, medium and low consumers of cereal and dairy products, and examined the potential use of this information for FBDG. Analysis of nutrient intakes across tertiles of cereal and dairy consumption showed that high consumers of wholemeal bread and breakfast cereals had lower fat and higher carbohydrate, fibre and micronutrient intakes than low consumers of these foods. High consumption of reduced-fat milk and yoghurt was also associated with lower fat and higher fibre and micronutrient intakes, particularly in women. According to these results, an increased consumption of wholemeal bread (by increasing the number of consumers or the number of servings or the serving sizes) could help to reduce the percentage of fat and to increase the intake of dietary fibre, folate and iron in Irish adults.

This example illustrates that a detailed analysis of the contribution of individual staple foods provides valuable information for the development of FBDG. It also shows the importance of identifying foods which account for a high proportion of inter-individual variability in the intake of a given nutrient (Leclercq and Arcella, 2001). Other examples can be found in the literature (Turrini et al., 1999; Anderson and Zlotkin, 2000; Matthys et al., 2006).

The development of FBDG targeted to specific population groups (such as children, elderly people, pregnant women or women of childbearing age, sportsmen) would require this type of analysis based on the relevant data.

Country-specific food cooking/processing that may affect nutrient content or bio-availability, as well as food availability and seasonality, should be further considered at this step. The contribution of fortified foods and dietary supplements to micronutrient intake should also be taken into account.

4.4.2. Food groups with established relationships to health

For some foods, there is evidence of health benefits that cannot be attributed to their specific content of nutrients. For instance, a higher consumption of foods from the fruit and vegetable group has been

associated with a lower risk of some chronic diseases (Eurodiet, 2000; WHO/FAO, 2003), an effect that cannot be easily explained on the basis of specific nutrients.

Fruit and vegetable consumption varies considerably among countries, in large part reflecting the prevailing economic, cultural and agricultural environments. Although data of household budget surveys reflect the availability of foods rather than the consumption, the data are a useful tool to depict comparisons between European countries. For instance, data from the DAFNE (Data Food Networking) database show that for fruit in Europe the mean availability per person per day is highest in the Southern countries (Figure 3). The availability of vegetables in Cyprus and Greece is much higher than in other European countries (Figure 4). National food consumption surveys at the individual level provide more information on the consumption in specific population groups, consumption occasions, differences among high and low consumers etc. and should preferably be used when available.

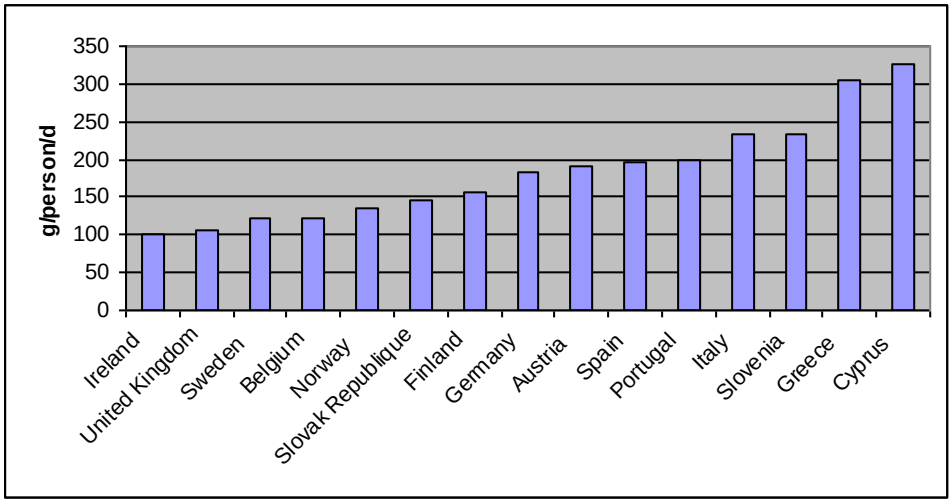

Figure 3: Mean availability of fruit in selected European countries in the period 1996-2000 (source: DAFNE; http://www.nut.uoa.gr/dafnesoftweb).

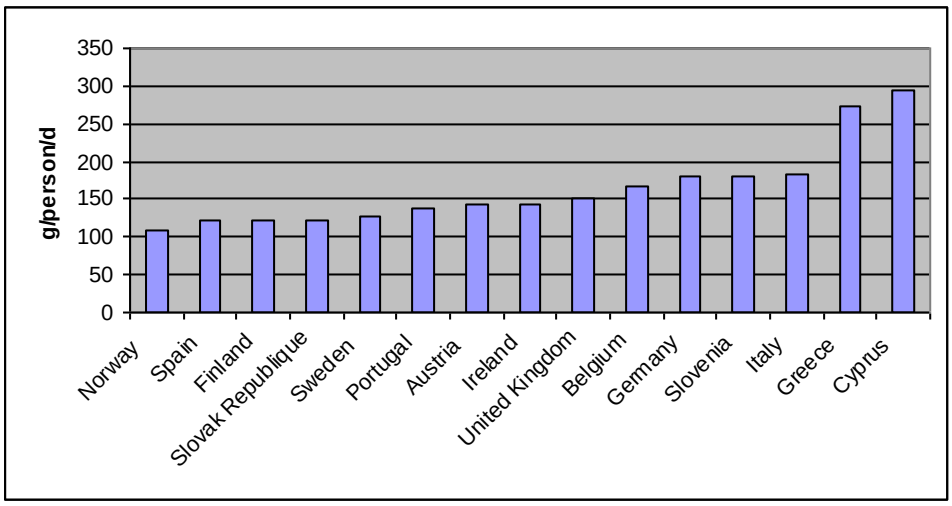

Figure 4: Mean availability of vegetables in selected European countries in the period 1996-2000 (source: DAFNE; http://www.nut.uoa.gr/dafnesoftweb).

In setting FBDG for individual countries it is therefore important:

- *to identify main dietary sources/rich sources of the nutrients of public health importance;*
- *to identify foods which explain differences between those who do and those who do not achieve target nutrient recommendations;*
- *to consider the level of consumption of foods with established relationships to health that are not nutrient specific.*

Indeed, some objectives and recommendations which have been shown to be associated with health can already be derived at this step for the general population or for high or low consumers of a specific food (sub)group. The first draft of the FBDG can thus be processed from that step for finalisation of guidelines and implementation (see section 5). However, whenever possible, one or more of the following steps (4.5 - 4.7) could be useful.

4.5. Identification of food consumption patterns

Epidemiological research is increasingly investigating the relationship of health with overall diet rather than with single nutrients, foods or food groups. Results from the Dietary Approaches to Stop Hypertension trial (DASH) (Appel et al., 1997, Sacks et al., 2001) showed that a diet rich in fruit, vegetables, nuts and low-fat dairy products has a favourable influence on some cardiovascular disease risk factors, including reduction of blood pressure. Various studies have indicated that consumption of a traditional Mediterranean diet is associated with reduced risk of mortality from cardiovascular diseases and certain types of cancer in several countries (Trichopoulou et al., 1995 and 2005; Lagiou et al., 2006; Kouris-Blazos et al., 1999; Osler and Schroll, 1997). Significant associations have also been observed between dietary pattern and dyslipidaemia (Van Dam et al., 2003), and the risk of chronic obstructive pulmonary disease (Varraso et al., 2007). These health benefits cannot be readily attributed to specific nutrient contents of such diets.

Food consumption patterns consist of specific associations of foods or food groups that can be distinguished within a population. The use of statistical techniques is required to define these patterns using food consumption data. In addition, the analysis might take into account other parameters, such as the distribution (nature and quantity) of the foods over the different meals, the chronology and the place of consumptions (Kearney et al., 2001; O'Dwyer et al., 2005). This can only be done if the relevant information is provided by the dietary survey.

Identification of food consumption patterns might be helpful in setting FBDG:

- to demonstrate or support the feasibility of the FBDG if some existing patterns already comply with nutrient recommendations and proposed FBDG;
- to ensure the coherence of recommendations for the total diet;
- to enhance cultural acceptability, targeted recommendations and targeted communication, because dietary changes may be more readily achieved if recommended foods are compatible with existing food consumption patterns.

To examine food consumption patterns, generally two approaches have been used, i.e. the a priori and the a posteriori approach.

The a priori approach is based on prevailing knowledge concerning favourable or adverse effects of various dietary constituents. Diets are assessed for the presence or absence of certain food or nutrient characteristics, and the resulting score is then operationalised as a dietary exposure variable (Kant, 2004, Patterson et al., 1994; Kennedy et al., 1995; Trichopoulou et al., 1995; Huijbregts et al., 1997; Haines et al., 1999; McCullough et al., 2002).

The *a posteriori* approach is data driven, with exposure summarised using factor or cluster analysis. Factor analysis may be considered as a pattern detection method that reduces the number of dietary variables by transforming the original large set of correlated dietary variables into a new, smaller set of uncorrelated variables, which are called principal components or factors (Prevost et al., 1997; McCann et al., 2001; Schulze et al., 2001; Balder et al., 2003; Van Dam et al., 2003; Costacou et al., 2003; Bamia et al., 2005, Varraso et al., 2007). In contrast to factor or principal component analysis, cluster analysis classifies persons into naturally existing, mutually exclusive groups on the basis of a similarity in food intake (Hulshof et al., 1992; Tucker et al., 1992; Wirfalt and Jeffry, 1997; Greenwood et al., 2000; Villegas et al., 2004).

Irrespective of the approach used, patterns characterised by fruit, vegetables, whole grain, fish, poultry consumption generally have been reported to relate to micronutrient intake, and to selected biomarkers of dietary exposure and disease risk in the expected direction (Kant, 2004).

The determination of country-specific food consumption patterns can be complemented by other analyses. When extended socio-demographic data are available in the dietary surveys, they allow characterising the population following each pattern. In the French survey INCA ("Enquête Individuelle et Nationale sur les Consommations Alimentaires"), five patterns have been distinguished using an a posteriori technique: the pattern rich in fruits and vegetables, with a low energy density and diversified diet is followed essentially by middle aged women (the population in the pattern is 80% women of which 75% are above 45 yr of age); on the opposite, the pattern rich in high energy dense foods, low in fruits and vegetables and with a low diversity is followed essentially by middle-aged men (90%) of medium or low socio-cultural categories (Martin, 2001). In the food consumption patterns distinguished by van Dam (2003) (see above), higher scores for the "traditional" pattern were associated with older age, and higher scores for the "refined-foods" pattern with younger age, but both were associated with lower educational level, cigarette smoking, less physical activity, and higher body mass index.

In setting FBDG for individual countries it is therefore important:

- *to identify main food consumption patterns in the population;*
- *to identify those patterns which are likely associated to a better health;*
- *to identify foods characteristic of the more favourable patterns or less favourable patterns as the basis for food intake recommendation;*
- *to identify the characteristics of the population for each pattern of food consumption for targeting recommendations and actions;*
- *to derive recommendations to be included in FBDG.*

At this step, finalisation and implementation of FBDG can be done (see section 5); however, whenever possible, one or both of the following steps should be useful.

4.6. Testing and optimising FBDG

This step is useful to confirm that adherence to FBDG is compatible with nutrient intake recommendations and does not lead to dietary imbalance. Consideration of different scenarios and iterative adjustments may help to optimise FBDG. Different modelling methodologies can be used on data based on household budget surveys (for instance DAFNE) and individual surveys, and some non-exhaustive examples are given below. Field testing can also be applied.

In Germany, Kersting et al. (2005) composed 7-day menus for children (4-6 years) and adolescents (13-14 years), taking into account the German meal patterns, common non-fortified foods, and sensory preferences of children (practical criteria). Food amounts and food selection within the menus were optimised in order to reach the German dietary reference values for 22 nutrients (scientific criteria).

Compared to the existing diet reported from the DONALD study, the Optimised Mixed Diet (OMD) was lower in fat and SFA. Nutrient densities for age groups were achieved or exceeded, except for folate. Foods from the optimised menus were classified into 11 food groups based on nutritional and practical considerations. Proportions of food groups were expressed by weight and could be used to recalculate food amounts for various age groups or energy requirement, respectively. For the communication to the general public (see section 5.1.1) it was simplified into the slogans "recommended foods" and "tolerated foods" distinguished by their nutrient densities. Three simple rules for food consumption were deduced, i.e. beverages and plant foods: ample; animal foods: moderate; high-fat, high-sugar foods: sparingly. The OMD demonstrates that a single diet concept with a core of quantified food groups can be adequate for age groups between 1 and 18 years within a country, such as Germany.

In the Netherlands, using data from recent dietary surveys, a number of food groups have been characterised as basic foods, i.e. groups of foods with a high nutrient density that are important for micronutrient supply in the typical Dutch diet. The other food groups, with a low nutrient density, but usually a high energy density, are considered as non basic food groups. Within each of these groups of basic foods, a tripartite classification (food to use "preferably", "middle road" and "exceptionally") has been made for each individual food, based on their nutritional quality. The criteria for this classification are based on analysis of the nutrient content of the typical Dutch diet in relation to the desired composition based on data from scientific (epidemiological) research. Data of the Dutch food consumption survey and model calculations have been used to quantify recommended amounts for all groups of basic food for different population groups. In general, the basic diet provides roughly the recommended amounts of various micronutrients but not sufficient energy. Therefore, consumers may choose from non basic food groups to fill this gap. Excessive energy intake should be avoided by providing tailored information on the energy content per serving (www.Voedingscentrum.nl).

In France, using data from a representative dietary survey, different methodologies were used to assess the possible impact of the implementation of the FBDG (Martin, 2001). To assess the recommendation about the consumption of dairy products, the average amount of dairy product intake of the average consumer has been determined (x g of full milk, y g of low fat milk, z g of yoghurt, n g of cheese etc.). The result of recommending the consumption of 3 milk products per day was calculated using the corresponding food composition table, providing an estimate of the possible average intake for all nutrients. The modelling is repeated for all the recommendations.

Linear programming (Ferguson et al., 2004) from a food database is now frequently used to establish diets fulfilling a set of constraints and goals (Ferguson et al., 2006; Rambeloson et al., 2008). It could also be used to identify the foods that are indispensable to establish diets which fulfil all the nutrient recommendations. The comparison of the result of linear programming to the actual food consumption can give quantitative estimates of the magnitude of the desirable change.

These techniques can also take into account food prices, especially when recommendations are made for people assisting low income persons. For example, it has been shown by linear programming that to comply with the population reference intakes in France at least 5 euros per day are required. This could be decreased to 3 euros by using cheaper and highly nutritious foods that are, however, not frequently present in the food repertoire of the target population group (Maillot et al., 2007). It is important for the successful implementation of recommendations that psycho-social factors, cultural practices and economical and environmental considerations are taken into account in the final recommendations.

In setting FBDG for individual countries it is therefore useful:

- *to model effectiveness and potentially undesirable effects on overall dietary balance;*
- *to modify and adapt FBDG according to the results of modelling and in accordance with conditions prevailing in the country.*

4.7. Graphical representations of the FBDG

For communication purposes to consumers (see section 5.1.1), it is often useful to present recommendations using graphical formats. These formats facilitate the promotion and dissemination of guidelines and increase their understanding, which will assist consumers in selecting a healthier diet (Koenig, 2007). Various formats have been used in different countries and are easily available in articles, books or websites. However, they would require adaptations to the country-specific FBDG which would need a scientific validation. Examples of graphic formats are food pyramid, food plate, food circle, food boat. In addition, interactive tools could be developed, e.g. for use on official websites (such as in USA, France). The best graphical formats for a given population should be determined in collaboration with people in charge of the communication.

In setting FBDG for individual countries it may be therefore useful:

- *to develop graphical representations of FBDG in order to facilitate communication to consumers;*
- *to adapt and validate existing tools for the country-specific FBDG or to develop country specific graphical tools.*

5. Implementation and evaluation of FBDG

Once established, FBDG need to be implemented and results monitored and evaluated. Since implementation is out of the remit of the Panel, only some indications about possible implementation strategies are indicated.

5.1. Implementation

Experience from countries, which already have developed FBDG, shows that the existence of FBDG is not always followed by the necessary compliance by consumers, awareness of policymakers and nutritional educators. Therefore, having FBDG alone is not effective in managing or preventing the diet related health issues. Their effectiveness depends on their integration into a coherent food nutrition policy going beyond communication to consumers alone (Stockley, 2001; Walter and Elmadfa, 2007; Albert, 2007).

Therefore, when established, FBDG can be used in different ways following an implementation plan.

5.1.1. Communication to consumers

The consistency of the communication of nutrition messages to consumers is essential.

This can only be achieved through a multidisciplinary, interactive approach involving professionals from various fields of expertise, such as communication experts, specialists in social sciences, cognitive sciences or psychology, specialists in food behaviour, and nutritionists.

When the final selections of foods (and quantities) have been made through the steps described in section 4, guidelines can be transformed into messages and slogans. For the general public it is important that messages are practical, comprehensible, simple, appealing and easy to remember. As a general rule, it could be recommended that these communications tools are pre-tested on representatives of the targeted population for a better adaptation of the tool. Post-testing can also be informative.

Governments, nutrition societies, consumer organisations or industry can use various channels and means for communication of FBDG messages depending on available resources: e.g. leaflets, booklets, media campaigns, TV promotional activities, labels and logos on food products. FBDG can also be integrated into the school educational curricula.

5.1.2. Communication to professionals

Adapted communication including the scientific rationale and background can be made to various health professionals, and FBDG should be integrated into their curricula.

Other professionals who could be targeted are those working in the food/diet area (such as canteen chefs, workers of the food industry) or in the area of services to disabled/elderly people.

5.1.3. Application to policies

Accepted FBDG can together with other nutrition related data be used as a basis of policies with respect to health and nutrition. FBDG could also be considered in devising meal programs of institutions or organisations such as school canteens, hospital, catering services.

5.2. Monitoring and evaluation

The implementation of FBDG should be accompanied by monitoring and evaluation of the effects. The results of the monitoring and evaluation should be used to introduce necessary changes in FBDG or their implementation.

Different types of indicators, both of implementation and effect, can be collected in various time frames, depending on the available tools and resources. Each country should define the indicators which will be measured at baseline and during the follow up, using already existing indicators or developing more specific indicators. It should be kept in mind that food consumption patterns and health status are influenced by several factors, so that most of these indicators do not allow unravelling the specific effect of implementation of FBDG, especially when other actions are implemented at the same time, especially in the context of nutrition-health policy.

5.2.1. Monitoring of implementation

Indicators of "activity" are the most simple and easy to collect: such as number and contents of leaflets, booklets, which are distributed/sold/requested over time, number and contents of advertising campaigns and their impact.

Consumer or health professional surveys can determine the awareness of the existence and the knowledge of the content of the guidelines.

The above indicators can be quantified; the impact of FBDG on policies can be assessed in a qualitative way.

5.2.2. Evaluation of the effects

The evaluation of effects can be based on the quantification of the evolution of food sales/purchases, food composition, food consumption and health status. These indicators do not have the same time scale, health status requiring the longest follow-up.

Changes in food sales/purchases - Different indicators already exist in many countries, sometimes since a long time, that allow monitoring of trends in food purchases or sales, either public (e.g. statistics of Ministries in charge of agriculture or economy) or private. Taking into account that they were not designed for this purpose and that sales or purchases do not reflect the true picture of consumption, their careful analysis and cautious interpretation may allow detection of changes in trends over time.

Changes in food composition - FBDG could have an impact on the composition of food products and on food reformulation by industry (Leclercq et al., 2001). The monitoring of such changes is important,

because the knowledge of nutrient contents of foods is essential to assess nutrient intake trends in a population (Beemster et al., 2000).

Changes in food/nutrient consumption - Indicators are obtained through representative individual dietary surveys. Indices of compliance with FBDG can be used (Kennedy et al., 1995; Rafferty et al., 2002). Recently, Fogli-Cawley et al (2006) developed the 2005 Dietary Guidelines Adherence Index (DGAI), an instrument consisting of a total of 20 items, to measure the adherence to the target dietary intake recommendations using individual dietary data. To enhance comparability of food consumption surveys across Europe, the results of the European programs EFCOSUM (Löwik and Brussaard, 2002) and DAFNE (Lagiou et al., 2001) should be taken into account.

Changes in health status - Indicators can include validated biomarkers as well as clinical endpoints such as morbidity and mortality. Whether there is a need for the development of more specific indicators in relation to diet could be addressed.

6. FBDG in Member States

In 2002, WHO assessed the existence of national, governmental-endorsed FBDG in 48 Member States of the WHO European Region. Of the 25 countries that reported to have national FBDG (either officially endorsed or not), most included information similar to that put forth in the CINDI guidelines. However, quantification of portions and sizes was often unclear and difficult to interpret. Important discrepancies in national FBDG were observed (WHO, 2003a). No information was available on the process of development of these FBDG.

To get more information on the availability of FBDG and the principles in setting these FBDG, a computerised questionnaire (Annex 1) was sent to 20 Member States and 13 responses were obtained. The results are briefly summarised in this section (see also Annex 2).
Eleven out of these 13 countries reported having FBDG. One country reported that their most recent FBDG dated from 1994; in the other countries they were established between 2001 and 2007. Most FBDG were country-specific. Two countries reported the use of the WHO CINDI dietary guide (one country together with FBDG from another country). In developing FBDG, eight countries reported to take into account country-specific diet-related health problems. Cardiovascular diseases, overweight/obesity, dyslipidaemia, hypertension, type 2 diabetes, osteoporosis and dental caries were mentioned most frequently (Figure 5).

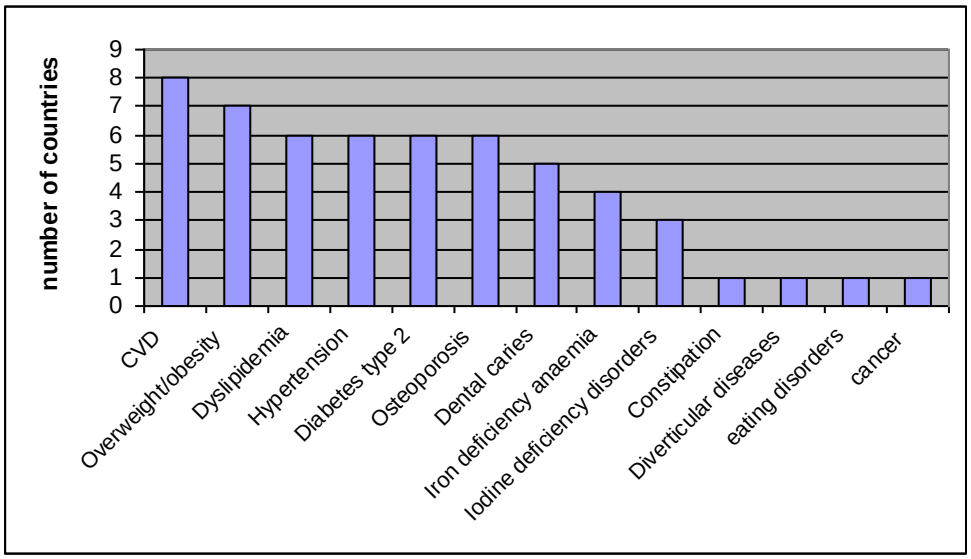

Figure 5: Diet-related health problems reported to be taken into account by FBDG in eight countries.

For reviewing food consumption patterns most countries used individual food consumption data, followed by food consumption data on the household level and national food supply data. For the assessment of adequacy of the diet, nearly all countries used their national dietary reference values. The number of principal nutrients addressed by FBDG varied between the eight countries. Only SFA and dietary fibre were mentioned by all eight countries, total fat, n-3 fatty acids, added sugars, calcium, iron and folate by seven countries. Energy, total protein, other fatty acids (MUFA, PUFA, n-6 and *trans* fatty acids), total carbohydrates and vitamin D were mentioned by six countries (Table 2).

Table 2: Principal nutrients reported to be addressed in national FBDG.

Eight countries	Seven countries	Six countries	Five countries	Four countries	Three countries	Two countries	One country
SFA	Total fat	Energy	Cholesterol	Animal protein	Plant protein	Total sugars	Phosphorus
Dietary fibre	n-3 FA	Total protein	Complex CHO	Zinc	Water	Iodine	Copper
	Added sugars	MUFA	Sodium	Vitamin A	Potassium		Alcohol
	Calcium	PUFA	Vitamin C	Vitamin B1	Magnesium		
	Iron	n-6 FA		Vitamin B2	Selenium		
	Folate	TFA		Niacin			
		Total CHO		Vitamin B6			
		Vitamin D		Vitamin B12			

SFA = Saturated Fatty Acids; FA = Fatty Acids; MUFA = Monounsaturated Fatty Acids; PUFA = Polyunsaturated Fatty Acids; TFA = Trans Fatty Acids; CHO = Carbohydrates

Seven food groups are common in the FBDG of nine countries: bread/cereals; rice/pasta/potatoes; vegetables; fruit; milk/dairy products; meat; fish. Other food groups included were oils/fats, legumes and eggs (Figure 6). In most countries the amounts of food were quantified or partly quantified.

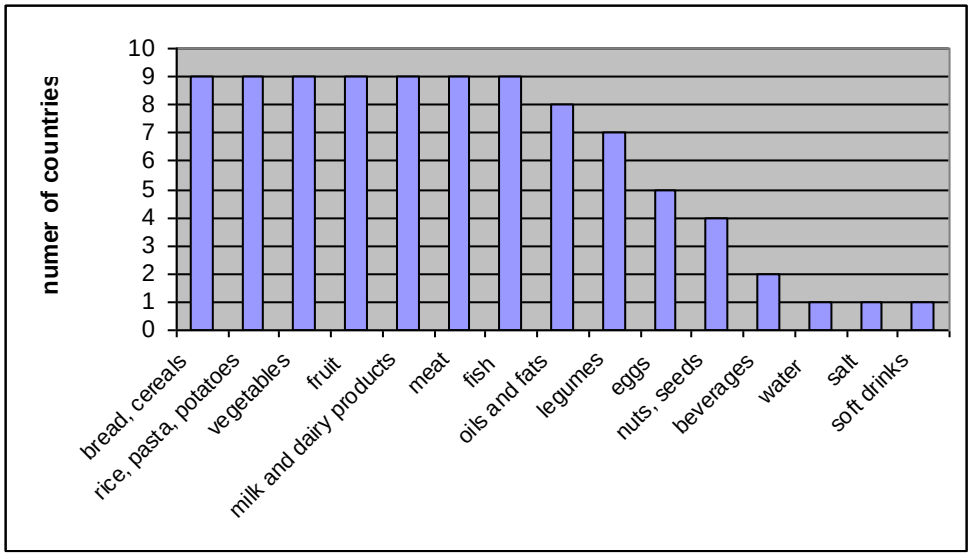

Figure 6: Food groups reported to be included in national FBDG.

Only three countries reported modelling of diets or performing simulation studies, to optimise guidelines and to study the effects of FBDG on the total diet before finalising FBDG.

FBDG were mostly directed to the general population and adults, but pregnant women, school children, pre-school children, adolescents and elderly were also mentioned.

Most countries included health-related and other messages in their FBDG. These recommendations were related to physical activity, food variety/balance, meal pattern and safety in cooking and preservation.

Five countries reported field-testing of FBDG before publication.

Most countries used a graphical representation of their FBDG. The use of food plates was reported five times, food pyramid and food circle three times each. In three countries no visual guides were used.

In most countries national nutrition or health institutes and/or the Ministry of Health were responsible for producing and revising FBDG.

Only three countries reported monitoring and evaluation of FBDG (Annex 2).

CONCLUSIONS AND RECOMMENDATIONS

From the analyses presented in this Opinion and the results of the survey on food-based dietary guidelines in the EU, the Panel considers that it is not feasible to establish detailed and effective food-based dietary guidelines which could be used at the EU level:

- the priorities in public health may differ between countries. In most EU Member States cardiovascular diseases, cancer, hypertension, dyslipidaemia, type 2 diabetes, overweight and obesity and osteoporosis can be identified as major public health issues. Therefore, it might be expected that food-based dietary guidelines in European countries can be based on the same diet-health relationships. However, the priorities of the diseases addressed by food-based dietary guidelines may substantially differ. From the survey reported in this Opinion, it appears that most reporting countries established recently their own national food-based dietary

guidelines and based their food-based dietary guidelines on country-specific diet-related health problems;

- the priorities in selecting principal nutrients may vary, depending on the country-specific nutrient intake levels and on the impact of the related diseases on morbidity and mortality rates and the desirable changes;
- there are wide disparities in dietary/cultural habits and the availability of food products between European Member States. Although the results of the questionnaire sent by EFSA to a number of European Member States give only a rough indication, there was little difference in the type of main food groups included in national food-based dietary guidelines. However, due to variation in and between food patterns in Europe, the differences in type of foods within main food groups and the recommended amounts might differ substantially. Thus, the individual country has to take the (final) decision which foods and in which amounts are important and appropriate to include in their national food-based dietary guidelines;
- In developing food-based dietary guidelines, it is important that the nutrient needs of the (target) population are covered. Therefore, it is recommended to conduct modelling and simulation studies of food-based dietary guidelines. There is clearly a lack of European representative consumption data to perform these modelling studies at the European level;
- Food-based dietary guidelines will fail if the public finds them culturally unacceptable. In implementing food-based dietary guidelines it is crucial that the messages are understood. Therefore, it is necessary to test food-based dietary guidelines before a full implementation; this is difficult to achieve at the European level. To be informative, pre-testing of food-based dietary guidelines should be performed on a specific population in a specific cultural and dietary context.

Therefore, in this Opinion, the main focus is on the scientific process of developing food-based dietary guidelines for the diverse European populations, following a stepwise approach (see section 4). Most steps can be achieved in different ways, depending on the desired change(s), the available information and the available resources. To be successful, the process of developing food-based dietary guidelines should be conducted using a multidisciplinary approach. Monitoring of the implementation and the compliance with food-based dietary guidelines is considered to be essential. These areas require improvement in several countries. The examples presented in several steps in this Opinion are meant to be an illustration of possibilities, without being exhaustive.

Establishing food-based dietary guidelines is an important step for the development of nutrition policies and for the dissemination of consistent information about a healthy diet and lifestyle. Food-based dietary guidelines should be integrated into other policies that have an impact on food availability within the population and also fit with other public health messages. Therefore, it is recommended to include into food-based dietary guidelines encouragement of daily physical activity and maintenance of a healthy body weight and, if suitable, also other lifestyle and health-related messages.

If a country has no national food-based dietary guidelines, it can adapt and/or utilise existing food-based dietary guidelines from neighbouring or similar countries that have already produced food-based dietary guidelines. The use of the CINDI (Countrywide Integrated Non-communicable Disease Intervention Project) guide might be also an interim alternative (WHO, 2000). The present EFSA Opinion could be helpful by presenting suggestions how to realise the adaptations and implementation at the national level.

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ANNEXES

ANNEX 1: QUESTIONNAIRE

NAME:

COUNTRY:

AFFILIATION:

E MAIL:

DATE:

In contrast to dietary reference values or recommended nutrient intakes, Food-Based Dietary Guidelines (FBDG) are the expression of the principles of nutrition education mostly as foods. They represent the form in which advice is provided to people to assist them in selecting a diet to meet their needs for health.

The aim of this questionnaire is to get more information on the availability and the type of FBDG used in the EU (candidate) Member States, and the way of coming to these FBDG.

To answer this questionnaire, please tick the relevant boxes.

We kindly ask you to send back the filled survey by e-mail to: wolfgang.gelbmann@efsa.europa.eu
Does your country have Food-Based Dietary Guidelines (FBDG)?

☐ yes ☐ no

In which year were (the most recent) FBDG established:

What is the origin of the FBDG used in your country?

3.1 ☐ yes, translation of the CINDI dietary guide, WHO

3.2 ☐ yes, translation of FBDG of other country, please specify the country:

3.3 ☐ specially developed for your country

If the answer is "yes" in 3.1 or 3.2 → please go directly to question No. 12

Are diet-related health problems in your country taken into account when developing FBDG?

☐ yes ☐ no (if "no" ⟶ go directly to question No. 6)

To which diet-related health problems your national FBDG are focused?

☐ Cardiovascular diseases ☐ Constipation

☐ Dyslipidemia ☐ Diverticular diseases

☐ Hypertension ☐ Iron deficiency anaemia

☐ Type 2 diabetes ☐ Iodine deficiency disorders

☐ Overweight/obesity ☐ Dental caries

☐ Osteoporosis ☐ Malnutrition

☐ Others (please specify)

What information was used to review food consumption patterns in your country?

☐ National food supply data

☐ Household data

☐ Individual food consumption data: please provide name and year of the survey:

☐ Were any other data used? Please specify:

Which dietary reference values (nutrient based recommendations, recommended daily allowances etc.) were used in assessing adequacy of the diet

☐ Not assessed

☐ Values from own country

☐ Values from other country: please specify

What key nutrients were determined to be addressed by the FBDG in your country?

☐ Energy ☐ Calcium

☐ Total Protein ☐ Iron

☐ Plant Protein ☐ Sodium

☐ Animal Protein ☐ Potassium

☐ Total Fat ☐ Magnesium

☐ Saturated fatty acids ☐ Selenium

☐ Monounsaturated fatty acids ☐ Zinc

☐ Polyunsaturated fatty acids ☐ Other minerals

☐ Omega-6 fatty acids ☐ Vitamin A

☐ Omega-3 fatty acids ☐ Vitamin B1

☐ Trans fatty acids ☐ Vitamin B2

☐ Cholesterol ☐ Niacin

☐ Total Carbohydrates ☐ Vitamin B6

☐ Complex Carbohydrates ☐ Folate

☐ Total sugars ☐ Vitamin B12

☐ Added sugars ☐ Vitamin C

☐ Dietary fibre ☐ Vitamin D

☐ Water ☐ Vitamin E

☐ Other food components:

☐ Other vitamins:

Which food (groups) are finally included in your national FBDG?

☐ bread, cereals ☐ meat

☐ rice, pasta, potatoes ☐ fish

☐ vegetables ☐ eggs

☐ fruit ☐ oil/fats

☐ legumes ☐ nuts, seeds

☐ milk and dairy products ☐ Other food groups:

Before finalising FBDG were modelling exercises, simulation studies etc. performed and were the effects on the total diet studied?

☐ yes ☐ no

if yes, please describe the modelling and the possible nutritional consequences of implementing one or more food-based dietary guideline(s):

To which population groups are the FBDG in your country directed?

☐ General population

☐ Elderly ☐ Schoolchildren

☐ Adult ☐ Pre-school children

☐ Pregnant women ☐ Infants

☐ Adolescence ☐ Others

Are amounts of foods quantified (recommended servings, portions or amounts)?

☐ yes; ☐ partly ☐ no

if yes or partly, please specify:

Are other health related messages (e.g. physical activity, smoking) included in your FBDG?

☐ yes ☐ no

if yes, please specify:

Are food safety (e.g. hygiene) messages included in your FBDG?

☐ yes ☐ no

if yes, please specify:

Are other messages (e.g. food variety, meal pattern) included in your FBDG?

☐ yes ☐ no

if yes, please specify:

Were any of the food-based dietary guidelines field-tested before publication?

☐ yes ☐ no

if yes, please specify:

Are FBDG in your country accompanied by graphs of food selection guides?

☐ None

☐ Yes, Food pyramid

☐ Yes, Food plate

☐ Yes, Food circle

☐ Yes, other, please specify

Who is responsible for producing and revising your national FBDG?

Are the FBDG evaluated and monitored?

☐ yes ☐ no

if yes, please specify:

Please indicate and specify available references regarding your country (e.g. recommendations, reports, websites…):

Please add any general or specific comment, you might have:

Thank you very much for the time you spent to complete this questionnaire!

ANNEX 2: RESULTS OF THE COMPUTERISED QUESTIONNAIRE (SEE ANNEX 1)

Q		yes	no
1.	Does your country have Food-Based Dietary Guidelines (FBDG)	11x	2x
2.	In what year were (the most recent) FBDG established	1994-2007	
3.	What is the origin of the FBDG used in your country		
a	translation of the CINDI dietary guide, WHO	1x	
b	translation of FBDG of other country	1x + CINDI	
c	specially developed for your country	9x	
4[1].	Are diet-related health problems in your country taken into account when developing FBDG?	8x	1x
5[1].	To which diet-related health problems your national FBDG are focused?		
a	Cardiovascular diseases	8x	
b	Dyslipidemia	5x	
c	Hypertension	6x	
d	Type 2 diabetes	6x	
e	Overweight/obesity	7x	
f	Osteoporosis	6x	
g	Constipation	1x	
h	Diverticular diseases	1x	
i	Iron deficiency anaemia	4x	
j	Iodine deficiency disorders	3x	
k	Dental caries	5x	
l	Malnutrition	0	
m	Others	eating dis.	
		cancer	
6[1].	What information was used to review food consumption patterns in your country?		
a	National food supply data	3x	
b	Household data	3x	
c	Individual food consumption data	8x	
d	other data? Please specify	3x	
7[1].	Which dietary reference values (recommended daily allowances, nutrient based		
	recommendations, etc.) were used in assessing adequacy of the diet?		
a	Not assessed	1x	
b	Values from own country	7x	
c	Values from own country and other country	1x	
8[1].	What key nutrients were determined to be addressed by the FBDG in your country		
a	Energy	6x	
b	Total Protein	6x	
c	Plant Protein	3x	
d	Animal Protein	4x	
e	Total Fat	7x	
f	Saturated fatty acids	8x	
g	Monounsaturated fatty acids	6x	
h	Polyunsaturated fatty acids	6x	
i	Omega-6 fatty acids	6x	
j	Omega-3 fatty acids	7x	
k	Trans fatty acids	6x	
l	Cholesterol	5x	

m	Total Carbohydrates	6x			
n	Complex Carbohydrates	5x			
o	Total sugars	2x			
p	Added sugars	7x			
q	Dietary fibre	8x			
r	Water	3x			
s	Calcium	7x			
t	Iron	7x			
u	Sodium	5x			
v	Potassium	3x			
w	Magnesium	3x			
x	Selenium	3x			
y	Zinc	4x			
z	Other minerals	P,Cu, I (2x)			
aa	Vitamin A	4x			
ab	Vitamin B1	4x			
ac	Vitamin B2	4x			
ad	Niacin	4x			
ae	Vitamin B6	4x			
af	Folate	7x			
ag	Vitamin B12	4x			
ah	Vitamin C	5x			
ai	Vitamin D	6x			
aj	Vitamin E	4x			
ak	Other vitamins	0			
al	Other food components	alc (1x)			
9[1].	Which food (groups) are finally included in your national FBDG				
a	bread, cereals	9x			
b	rice, pasta, potatoes	9x			
c	vegetables	9x			
d	fruit	9x			
e	legumes	7x			
f	milk and dairy products	9x			
g	meat	9x			
h	fish	9x			
i	eggs	5x			
j	oil/fats	8x			
k	nuts, seeds	4x			
l	Other food groups	water 1x; salt 1x			
		beverages 2x;			
		soft drinks 1x			
10[1].	Before finalising FBDG did you make model diets, simulation studies etc?	3x		6x	
11[1].	To which population groups are the FBDG in your country directed?				
a	General population	7x			
b	Elderly	4x			
c	Adult	6x			
d	Pregnant women	5x			
e	Adolescence	4x			
f	Schoolchildren	5x			
g	Pre-school children	5x			
h	Infants	3x			
i	Others	0			

12.	Are amounts of food quantified (recommended servings, portions or amounts)?	7x			
	(partly)	4x			
13.	Are other health related messages included in your FBDG?	8x		3x	
14.	Are food safety messages included in your FBDG?	6x		5x	
15.	Are other messages (e.g. food variety, meal pattern) included in your FBDG?	9x		2x	
16.	Were any of the food-based dietary guidelines field-tested before publication?	5x		6x	
17.	Are FBDG in your country accompanied by graphs of food selection guides?				
a	None	3x			
b	Food pyramid	3x			
c	Food plate	5x			
d	Food circle	3x			
e	Other	1 (key hole)			
18[1].	Who is responsible for producing and revising your national FBDG?	6x National Institutes			
		(NI)/administrations			
		2x Ministry + NI			
		1x Ministry			
19.	Are the FBDG evaluated and monitored?	3x		8x	
[1] answers based on countries with specially developed FBDG (Q 3.3)					

GLOSSARY / ABBREVIATIONS

AICR	American Institute for Cancer Research
AR	Average Requirement
CHO	Carbohydrate
CINDI	Countrywide Integrated Non-communicable Disease Intervention Project
DAFNE	Data Food Networking
DASH	Dietary Approaches to Stop Hypertension Trial
DGAI	Dietary Guidelines Adherence Index
DHA	Docosahexaenoic Acid
DONALD	Dortmund Nutritional and Anthropometric Longitudinally Designed (Study)
DRV	Dietary Reference Values
EC	European Commission
EFSA	European Food Safety Authority
EPA	Eicosapentaenoic Acid
EPIC	European Prospective Investigation into Cancer and Nutrition
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FBDG	Food-based dietary guidelines
FFQ	Food Frequency Questionnaire
HBS	Household Budget Survey
HDL	High Density Lipoprotein
HHS	US Department of Health and Human Services
ICN	The International Conference on Nutrition
INCA	"Enquête Individuelle et Nationale sur les Consommations Alimentaires" (national individual survey of food consumption)
IoM	Institute of Medicine
IOTF	International Obesity Taskforce
LDL	Low Density Lipoprotein

MUFA	Monounsaturated Fatty Acid
OMD	Optimised Mixed Diet
PRI	Population Reference Intakes
PUFA	Polyunsaturated Fatty Acid
RI	Reference Intake ranges for macronutrients
SFA	Saturated Fatty Acid
SCF	Scientific Committee for Food
USDA	United States Department of Agriculture
WCRF	World Cancer Research Fund
WHO	World Health Organization