A Framework for Food-Based Dietary Guidelines in the European Union

Working Party 2: Final report[+]

22 February 2000

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Keywords

Food-Based Dietary Guidelines, strategies, analytical approaches

+ This report is based on the contributions of experts involved in Working Party 2. See Preface.

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Abstract

The nutrient targets derived from analysis of the relation between nutrient intake and disease prevalence or other scientific evidence, have to be translated into food-based guidelines in order to be understood by the general population. Furthermore, Food-Based Dietary Guidelines (FBGD) have to be realistic, attainable and culturally acceptable and should also give consideration to relevant social, economic, agricultural and environmental factors affecting food availability and eating patterns. This requires a thorough understanding of the relation between foods, food patterns and nutrient intakes in the population. The aims of Working Party 2 were to propose a framework for strategies in the development of FBDG and to examine existing data for nutrient and food intakes in the EU.

Methods. The over-all strategy given by the joint FAO/WHO consultation 1995 was used as the starting point, i.e. target foods or food patterns for public health nutrition programmes should be identified from an analysis of prevailing food and nutrient intakes. Prevailing data for food and nutrient intakes in 14 EU countries were examined and different principles and options for the derivation of FBDG were explored. Methodological issues and their influence on the interpretation of data for the development of FBDG were also examined.

Results. The process from nutrients to foods can briefly be: 1) identification of major food sources of the nutrient of interest, 2) identification of foods contributing substantially to population intakes, 3) identification of foods or food patterns compatible with desirable nutrient intakes or explaining variations in nutrient intakes, 4) formulation of FBDG into foods, portion sizes, frequency of intake, meal composition taking attainability and acceptability as well as compatibility of co-existing guidelines into account.

The level of complexity that can be applied in the analytical approaches depends on the characteristics of available intake data. A detailed analysis requires data on an individual level for nutrients, foods, food patterns, eating and meal habits etc. When individual data are available different analytical approaches (examination of distribution of intakes, correlation analysis between foods and nutrients, examination of food intakes in compliers/non-compliers to nutrient goals, discriminant analysis, cluster/factor analysis) can be used to identify key foods or food patterns fulfilling nutrient goals.

The examination of prevailing food and nutrient intake data in the EU revealed:

- a number of methodological differences in approaches to dietary surveys exist in the EU countries e.g. regarding methods used, selection of population, classification of foods, which have to be kept in mind in pan-EU comparisons;
- at present there is a substantial gap between actual intakes and present nutrient goals suggesting that major changes of dietary habits are needed;
- while some food patterns were consistently related to intake of specific nutrients in most EU countries, other patterns showed large variations between countries;
- methodological issues, such as survey duration, survey techniques, under- or over-reporting, could have substantial influence on the identification of target foods or food patterns.

Conclusions. A science-based analysis of nutrient and food intakes allows development of FBDG, which, if implemented, are likely to result in mean population intakes closer to nutrient goals. Acknowledging the social and cultural differences within the EU as well as the need to focus on the most relevant public health problem in the population, FBDG should first be developed within member states. Harmonisation of survey methods within the EU would facilitate development of regional and EU FBDG.

1. Introduction

The plan of action of the International Conference on Nutrition (ICN) called for the dissemination of nutrition information through "sustainable food-based approaches"[1]. Food-based dietary guidelines (FBDG) are guidelines derived from nutrient targets or dietary goals that are translated into "food-based guidelines" in order to be adopted by the general population. They represent the practical way to reach the nutritional goals of the population. For this reason, it is essential that FBDG are practical, comprehensible and culturally acceptable, and that they reflect food patterns rather than numeric goals. FBDG may vary in terms of specificity and target audience (may be general population or specific subgroups in the population). FBDG can be fairly broad and unspecific, for example "eat more fruit and vegetables" or more specific, for example "eat at least five servings of fruit and vegetables a day" or targeted and detailed, for example "women of fertile age should avoid whole liver" or product specific, for example "use low fat varieties of milk and milk products" or meal based, for example "eat fruit and vegetables at every meal". Usually FBDG will cover amounts/serving sizes and frequencies of consumption of food groups or specific foods, or proportions between meal components.

In 1995, a joint FAO/WHO consultation on FBDG was convened and its report recommended the identification of potential target foods in specific public health nutrition programmes based on dietary patterns of consumers with low and high dietary intakes of target nutrients or based on some other analysis of prevailing food and nutrient intakes[2]. The report specifically advises that FBDG be established "on what can be realistically achieved in the socio-economic context rather than on an attempt to eliminate in one step the entire difference between the desired and actual intake". The use of traditional nutrient-based guidelines has to date only met with limited success in trying to attain national dietary goals for the population[3]. The limited success of such guidelines may be attributed in part to lack of perceived attainability[4], acceptability and contradictory elements within guidelines. FBDG need to be developed with consideration to these elements. In 1998 the Institute of European Food Studies conducted a study to examine prevailing patterns of food and nutrient intakes in the EU, to examine lower and upper nutrient intakes within EU member states[5]. The study enabled the exploration of principles and options for the derivation of FBDG. Some of the methodological issues to be considered when developing FBDG, and the analytical approaches to developing FBDG along with some examples of nutrient and food patterns across several EU member states as well as an example illustrating the results of different approaches are shown in this report.

2. A Step by Step approach to developing FBDG.

The development of FBDG has to rely on the characteristics of available data for intake of foods and nutrients in the population. When detailed and validated information for the distribution of intakes within the population is available more advanced analytical approaches can be applied. The process can briefly be described by the following steps with increasing level of complexity.

Step 1. Identification of major food sources of the nutrient of interest.

Foods with a high content of the nutrient of interest either on a weight basis or in relation to energy or protein content can be identified by the use of food composition tables and are potential candidates for a FBDG. Although this approach does not take cultural aspects and prevailing dietary habits into account, a basic knowledge of the food habits in the population allow some common sense decisions to what extent these specific foods are relevant for FBDG.

Step 2. Identification of foods providing a substantial part of the total intake of the nutrient of interest in the population.

For this you may use data from Food Balance Sheets or Household Budget Surveys. These foods are presumably culturally accepted foods and it may be possible to further increase/decrease intake of such foods. However, where available, individual based surveys should be used as they will provide more detail.

Step 3. Identification of foods or food patterns discriminating opposite patterns of nutrient intakes (desirable versus undesirable).

To do this you need data from Individual Dietary Surveys. Quantiles, compliers/non compliers etc are methods for characterisation of food patterns that may be used. The assumption is that the intake of a specific nutrient may be more readily increased/decreased if the desired level of intake is already attained in some segment of the population making it a more culturally accepted strategy. More advanced analytical approaches e.g. including several targets simultaneously in the analysis, are likely to give a more comprehensive understanding of the relation between foods, food habits and nutrient intake.

Step 4. Identification of key foods explaining variations in intake between individuals, consumer/non-consumers.

This step requires data from individual Dietary Surveys. Once a food is found to be an important determinant of the intake of a nutrient for which a change is desirable then different strategies are possible to alter its level of consumption. If a key food is consumed by a large proportion of the population, there are two options that may be considered to increase its consumption: increase portion size and/or frequency of eating occasions. The same, but opposite approach is applicable if a decrease in consumption is desired. The feasibility of such strategies and the extent of change that might be attained within the population may be evaluated by consumer research e.g. qualitative attitudinal research such as focus groups.

Step 5. Formulation of FBDG.

This step involves aspects such as menu-planning in terms of portions and frequencies, combination of portions and frequencies into meals and defining some basic principles regarding the choice of similar types of products (e.g. choice of low-fat dairy products, types of spreads, relation between whole-meal and white bread etc). This requires detailed information about prevailing patterns of food and meal habits, which dishes are used, which foods are eaten together, in-between meals etc. Based on the results, different types of FBDG can be formulated.

The above options or strategies for dietary change refer to nutrition education. Another basic, and possibly more rapid strategy for change is to change the supply of food. New products as well as modifications to existing products (enrichment etc.) are possible options to choose from.

3. Analytical approaches to FBDG

In the development of food-based dietary guidelines (FBDG) several approaches may be used to identify which foods best discriminate opposite patterns of nutrient intake and these are presented below.

3.1 Quantiles

When formulating FBDG, the existing dietary patterns of the population must be determined and then the food intakes of those with desirable and undesirable intakes of the relevant nutrient(s) or food must be examined. By using the prevailing nutrient intake distribution as a starting point the population can be separated into groups (tertiles, quartiles or quintiles) on the basis of a nutrient selected to be of special interest. Examples of its use in 13 EU countries may be seen[5]. When using this approach, subjects in the population are classified into 3, 4 or 5 groups, whereby the classification is based on the subjects' intake relative to the intake levels of the other subjects. For example, it was found that in the quantile with the highest iron intake the intake of energy, fibre and the total intake of many foods were higher than in the lowest quantile. When developing FBDG, it may be more appropriate to use energy-adjusted figures for micro-nutrients. One possible way to increase iron intake in the population would be to increase levels of physical activity and thereby the total intake of foods, including iron rich foods.

3.2 Compliers / non-compliers:

Another and rather a novel approach for putting people into two groups reflecting desirable and undesirable levels of intakes for a particular nutrient was used by the UK[6]. They classified the population into compliers and non-compliers, based on their intake relative to the dietary reference value (DRV) (for the particular nutrient in question)[6]. With this method subjects are ranked from lowest to highest. The average intake among those with lower intakes is calculated and more individuals of increasing intake are added until the average of the group has reached the DRV (for example in the case of percentage energy from total fat 35%). This group is called the "compliers" while all the rest are the "non-compliers". Some of the compliers will have intakes exceeding the DRV however the average level of the compliers as a whole will be at the DRV. Having identified these two groups with respect to a target nutrient, discriminating foods and food habits between the two groups are identified so that the food patterns and food habits of the compliers may be used in any strategy to reach the desired goal (for the target nutrient) in the overall population.

3.3 Discriminant analysis

A somewhat more sophisticated method to study differences is discriminant analysis. This method may be used to statistically distinguish between two or more a priori defined groups of subjects by determining how one or more independent groups discriminate. In the case of FBDG these groups of subjects will primarily be defined by dietary intake, whereby the starting point can be food groups or nutrients. To distinguish between the defined groups discriminating variables are selected that measure characteristics on which the groups are expected to differ. To select the most useful discriminating variables a step-wise procedure is advised whereby the single best discriminating variable is selected first and then the second etc. An example of discriminant analysis using data of iron intakes among adult Dutch women in the lowest and highest quartile revealed that potatoes, red meat, sausages, offal, savoury snacks and total vegetables were found to be most predictive for differences in iron intake among Dutch women. Such data may be useful when developing FBDG, as illustrated by this example for Dutch women.

3.4 Cluster / factor analysis

Cluster analysis empirically identifies patterns by grouping individuals with similar characteristics, producing homogeneous and statistically non-overlapping exposure categories. Cluster analysis has successfully been used to identify food patterns that characterise different population sub-groups and for identifying patterns that differentially predict disease risk[3, 7]. Using data of the first Dutch national Food Consumption Survey showed that in comparison with the guidelines, the dietary quality in 4 of the 8 clusters was poor. The cluster with the poorest dietary intake (high intake of fat and a low intake of dietary fibre) had on average a high consumption of animal products (except milk) and a low consumption of fruit, vegetables, potatoes and sugar rich products.

Factor analysis is another patterning methodology to explore interrelationships among variables to detect underlying and unobserved factors. A factor analytical approach was used in a Finnish study to investigate which factors in the nutrient content of foods were connected with the ability of foods to improve the nutrient density of the Finnish diet[8]. For the analysis a sample of regularly used foods (143) and dishes (244) were selected from the food database. The factor analysis was performed both using the energy-adjusted and weight based nutrient composition of the foods in the whole sample. The main factors to explain the ability of Finnish foods to improve the diet (expressed as nutrient density index) were the vegetable factor (explaining 31%) and the low fat - high carbohydrate factor (explaining 12%) in the energy adjusted foods and dishes.

In developing FBDG a minimum approach might be to compare the opposite quantiles of a nutrient intake distribution in terms of foods. Then, more sophisticated approaches could be used to set priorities for FBDG, to quantify them and to evaluate them in another study.

4. An analysis of present nutrient and food patterns in the EU (in relation to selected nutrient recommendations).

The criteria for FBDG to be practical, comprehensible and culturally acceptable will probably mean that for many nutrient goals national or even regional FBDG will have to be developed. However, for certain nutrient recommendations pan-EU FBDG may be developed. This requires a thorough analysis of the similarities and differences in food and nutrient intakes in the EU. In an attempt to explore the process of developing methodologies for establishing FBDG in the EU, the Institute of European Food Studies conducted a study involving the participation of all member states in the EU. The study attempted to compare patterns of food and nutrient intake in the EU against prevailing dietary guidelines and variations in food intake at the upper/lower end of several target nutrients and some foods of public health significance.

When making comparisons in the patterns of food and nutrient intake across EU countries, methodological differences in approaches to dietary surveys need to be considered. Not all countries in the EU have intake data at the level of the individual for the country as a whole. In this study for example three countries (Greece, Portugal & Spain) used regional studies. Survey duration should also be considered when making comparisons in food and nutrient intake between countries. While survey duration does not influence mean total population intakes, it does influence % consumers, mean intakes of the section of the population actually consuming the food or nutrient (consumer only intakes) and the distribution of both consumer only and total population intakes. Other factors which ought to be considered when comparing food and nutrient intake patterns between countries include; timing of the survey, definitions of food and food groups, choice of cut-off (tertiles, quartiles, compliers), food composition databases and population used in this analysis.

The following section gives a number of tables of nutrient and food patterns. In collating these tables it is important to be aware that the definition of food groups and the particular population groups on which the analysis was based differed between countries. Harmonization of food codes, such as Eurocode 2 may be useful in overcoming this difficulty of food classification. Figure 1 is a comparative figure showing mean % fat energy, % SFA, fibre (g/d) and folic acid (µg/d) intakes in the lowest and highest quartiles from a number of EU countries in relation to the recommendations for these nutrients. In each instance, it demonstrates the gap between the actual situation and what is recommended.

Most EU countries have recommendations regarding a reduction in total fat intake (as % of energy) and for changes in the fatty acid composition towards a lower content of SFA. Table 1 gives the composition of dietary fat (% w/w) among those in the lowest and highest quartiles of % energy as fat in selected countries. In going from the lowest and highest quartile, the composition of fatty acids remains largely unchanged. Thus, while lower fat diets are unquestionably associated with lower intakes of SFA, there are also reductions in MUFA and PUFA on lower fat diets. So lower fat diets have the same fatty acid composition as higher fat diets in both Northern and Southern Europe. People on a low fat diet are simply eating less of the same balance of fats. Greece (Crete) and Sweden are two exceptions with those in the highest quartile of fat intake (% energy) having a higher % energy from SFA compared to those in the lowest quartile, while in Greece (Crete) they have a 6% higher MUFA (% energy) in the highest quartile compared to the lowest. Table 2 shows the total fat content among those in the lowest and highest quartiles of intake for total fat, SFA, fibre and fruit and vegetables in selected EU member states. In most countries a higher fat energy % was found among those in the lowest quartiles of intake for fibre and for fruit and vegetables compared to the highest quartiles of intake.

An increased intake of fruit and vegetables is at present close to a pan-EU recommendation. The following three tables (Table 3-5) demonstrate food intake patterns (mean total population intakes, mean intakes among consumers and the percentage of consumers of various foods) among subjects from the lowest and highest quartiles of saturated fat and "fruit and vegetables". This should enable us to see how food intakes vary among subjects from the lower and upper end of the distribution for the nutrient and food group "fruit and vegetables" and to what extent such food intake patterns vary between countries.

Table 3 shows mean total population intakes of specific foods among subjects in the lowest and highest quartiles of fruit and vegetable intake in several EU member states. One striking feature is the very low intakes of fruit, and to a lesser extent vegetables, among subjects in the lowest quartile in all countries in the analysis. Patterns of food intake between subjects with low and high intake of fruit and vegetables varied between countries. For example, high intake of fruit and vegetables was associated with a high intake of potatoes (except Finland), but a low intake of cheese (Ireland). Such an example highlights the cultural influence on food intake patterns. However, it must be remembered that the populations in each country may not be nationally representative, e.g. sub-groups in the populations defined by gender such as, women in Sweden, men in Germany or by regions, Catalan in Spain, Crete in Greece. Mean total population intakes of specific foods among subjects in the lowest and highest quartiles of saturated fat intake (% energy) in a number of EU member states is shown in Table 4. Intakes of both fruit and vegetables were higher among those in the lower quartile of intake compared to the highest quartile. However, the level of fall in intakes going from the lowest to the highest quartile was greater for fruit than for vegetables. Those foods which were consumed in higher amounts among those in the highest quartile of saturated fat intake compared to the lowest included sausages and other processed meats, biscuits and cakes. This pattern applied for all countries in the analysis. Another consistent pattern was found for alcoholic drinks which was inversely related to saturated fat intakes (% energy). This type of relationship is to be expected when % energy from macro-nutrient sources has not been controlled for % energy from alcohol.

Data comparing % consumers and mean intakes among consumers can be useful in exploring the dietary options for developing food-based dietary guidelines[9]. The % consumers and mean intakes among consumers for those subjects who are in the lowest and highest quartiles of fruit and vegetable intake are shown in Table 5. While there were large differences in the % consumers of fruit between quartiles, the difference in % consumers of vegetables was considerably smaller. Thus, it may not be appropriate or effective to combine fruit and vegetables as a single aggregated food group when making recommendations to increase their level in the population. Rather, the data suggests that in order to increase fruit consumption, different and separate strategies are required than those required for increasing vegetable intakes.

5. Methodological issues to be considered when developing FBDG

The development of FBDG from existing dietary databases relies on the correct identification and interpretation of dietary intake patterns. A number of important methodological issues need to be considered in the interpretation of dietary data for developing FBDG.

5.1 Survey duration

Survey duration influences estimates of food intake and the classification of individuals. This can have implications for the development of food-based dietary guidelines as their development depends on the correct interpretation of the dietary patterns for the population. Short survey duration may result in a high degree of within-person variation and may not reflect long term or usual food and nutrient intakes. Consequently, estimates of intakes from surveys of a short duration may not give a true picture of usual or long-term intakes in the population. Increasing survey duration serves to reduce the spread in the distribution, having the greatest influence on the extreme values by reducing the tails of the distribution. Thus, short survey duration may lead to misclassification into high and low consumers. Increasing survey duration greatly reduces the level of misclassification and particularly the level of gross misclassification. Such gross misclassification occurs where individuals are classified as being among the highest tertile of intake on 1 day of measurement and in the lowest tertile of intake on 7 days of measurement. However, it is not likely that such misclassification (due to a short survey duration) will result in a systematic bias. Rather the effect is expected to be random, leading to a masking or dilution of the true effect. Thus the biggest potential mistake would be the conclusion that there is no association whereas in reality there is one. On the other hand, increasing survey duration may lead to under-reporting of food intakes because of the burden for involved subjects (both sampled individuals and interviewer/dieticians). There is a need for further enhancement of survey tools which should match both needs of information and acceptability of the survey.

As survey duration increases the % consumers for a particular food or food category increases and the intakes among consumers only decreases. Where sample size exceeds 200, mean intakes for the total population will not be greatly influenced by survey duration[10]. When interpreting dietary data for the development of FBDG, knowledge of the number of days on which the estimates are based is desirable in order to consider its likely quality.

5.2 Survey technique

The survey technique, be it weighed methods and recall, diet history or food frequency questionnaires (personal interview: face-to-face, telephone or self-administered e.g. mailed) provide a different degree of precision of the results. All methods applied in a standardised way allow one to rank individuals but the quantitative evaluation of food intakes varies considerably. Therefore the interpretation of data must take into account the measurement method.

5.3 Under-reporting

Ideally, FBDG should be based on valid food intake data representative for the target population. However, most dietary survey methods have been found to underestimate food intakes to varying degrees and this will be reflected in the energy and nutrient intakes. The extent of under-reporting of the energy intake can be evaluated by use of the concept of “cut-off values"[11] which is based on the ratio between the observed energy intake and the estimated BMR (EI/Mrest) for a specified energy level. At the individual level the cut-off value for likely under-reporting is dependent on survey duration and energy expenditure level.

Under-reporting can have implications in the development of FBDG in a number of ways. In a recent analysis of national surveys from 5 EU member states using different methodologies found that gross under-reporting of energy intake occurred among 8-29% of subjects[12]. Such under-reporting may be systematic or non-systematic and may affect the proportion of subjects classified as achieving the nutrition recommendations or not. When systematic, where there is general under-reporting of all foods to the same extent, then adjusting the energy intake level to a certain level may be useful. The energy adjusted food consumption should be similar among those classified as under and credible reporters. Under-reporting associated with a lower consumption of all foods may be due to a larger proportion of non-consumers, less frequent consumption and smaller portions. Non-systematic under-reporting of certain foods may also occur. In a Swedish national survey under-reporting was associated with lower consumption frequencies for fruit and vegetables, while portion sizes were similar among low and credible reporters[13].

In the case of micro-nutrients, under-reporting will lead to an overestimation of the proportion of the population not meeting a certain recommendation. If under-reporting is not taken into account then biased dietary advise or other nutrition policy actions may ensue. However, the results of the biomarkers found that the effect of under-reporting in relation to the development of FBDG is relatively small, whereby the concept is not greatly distorted by this reporting-bias[14].

The extent of under-reporting (both systematic and non-systematic) could influence the outcome of FBDG in terms of which dietary changes are most desirable or attainable. Under-reporting can also affect the formulation of food-based dietary guidelines in terms of realistic portion sizes and the frequency of consumption of various foods. Thus, low energy intakes may be an important pitfall when implementing FBDG.

5.4 Food Composition Tables

Food Composition Tables (FCT) represent a key tool for evaluating dietary intakes from the nutritional point of view. The majority of food consumption studies base the nutritional evaluation of the diet on FCT. The calculation of the BMR ratio itself used to validate the dietary data (see above) is calculated after the estimation of the individual energy intake. This means that the quality of FCT, e.g. with regard to completeness and correspondence to foods consumed by the study population, could strongly influence the basic information for developing FBDG. Therefore, issues raised by the use of FCT should carefully be taken into account when comparing data. There is a need for analytical composition data specific for each country but also for it to be comparable and compatible.

6. An illustrative example of developing FBDG

6.1 Public health issue: obesity

Obesity is a serious and chronic medical condition associated with a wide range of life-threatening diseases and resulting in enormous financial costs being borne by health care systems and the community itself[15]. Economic analysis has revealed that the direct and indirect health costs that are attributable to obesity costs are around 5% of the total health budgets of affluent countries such as in the E.U. The principal methods used in the treatment of obesity involve diet, exercise, a combination of the two, as well as pharmacological interventions. Dietary guidelines in virtually all E.U. member states recommend a decrease in total fat (range 30% - 35%).

The following example with the nutrient total fat (% fat energy) will serve as an illustration in developing food-based dietary guidelines. It also demonstrates how such guidelines developed in cultural context may differ to simply selecting food sources rich in the nutrient in question. For the purposes of this exercise, data on 715 adults (≥18 years) from the first Irish national food consumption survey (INNS) was used[16]. The 7-day diet history method was used to collect information on food consumption. When trying to decrease the intake of a nutrient, in this case, fat in the population one of the simplest approaches is to first identify foods that are rich dietary sources of the nutrient. This may be done by looking up a food composition tables such as McCance & Widdowson's a Food Composition Tables. However, such a method (Table 6) does not take account of the cultural context or prevailing dietary patterns within a specific population. Such a method takes no account of whether the food is consumed or not and to what extent it is consumed. Using this approach, spreads and oils, nuts (e.g. Brazil, almonds, peanuts), cheese (e.g. cream cheese, stilton, Danish blue) are identified as large fat contributors (when considered in terms of grams of fat per 100 grams of food).

An approach which does take account of whether the food is consumed and the level to which it is consumed, is to determine the main contributors to the intake of a nutrient e.g. total fat (% fat energy) in the defined population. This is done using the data from a food consumption survey. Table 7 gives contribution to total fat intake (% fat energy) and % contribution to total fat intake in Irish adults (18 years +). Fresh meat, spreadable fats, milk and biscuits, cakes, pastries were the four main contributors of fat to the diet of Irish adults, together contributing 62% of total fat intake.

While this second approach certainly identifies the main food source of fat in the Irish diet, it does not provide us with information on how to decrease fat intakes. Identifying those foods which best discriminate opposite patterns of nutrient intake can be done in a number of ways. These range from a simple and more descriptive approach using quantiles to more sophisticated analysis using discriminant, factor and cluster analysis. These approaches are discussed in Section 3. In this example, the food intakes, nutrient patterns of those with desirable and undesirable intakes of total fat (% fat energy) are examined. Using the prevailing nutrient intake distribution, the population was separated into quartiles on the basis of % fat energy.

The following table (Table 8) examines the food intake patterns (mean total population intakes, % consumers, mean intakes among consumers only) among subjects in the lowest and highest quartiles of total fat intake (as %fat energy). This will identify those foods that discriminate between low and high intakes. In the case of total fat intake, it is low intakes that are desirable (while in the case of another nutrient such as fibre it would be high intakes that would be desirable). People from the lowest quartile had a lower intake of energy (MJ) and a higher intake of energy adjusted fibre (g/MJ) compared to those from the highest quartile. Alcohol intake (in % energy) was twice as high in those from the lowest quartile compare to the highest quartile.

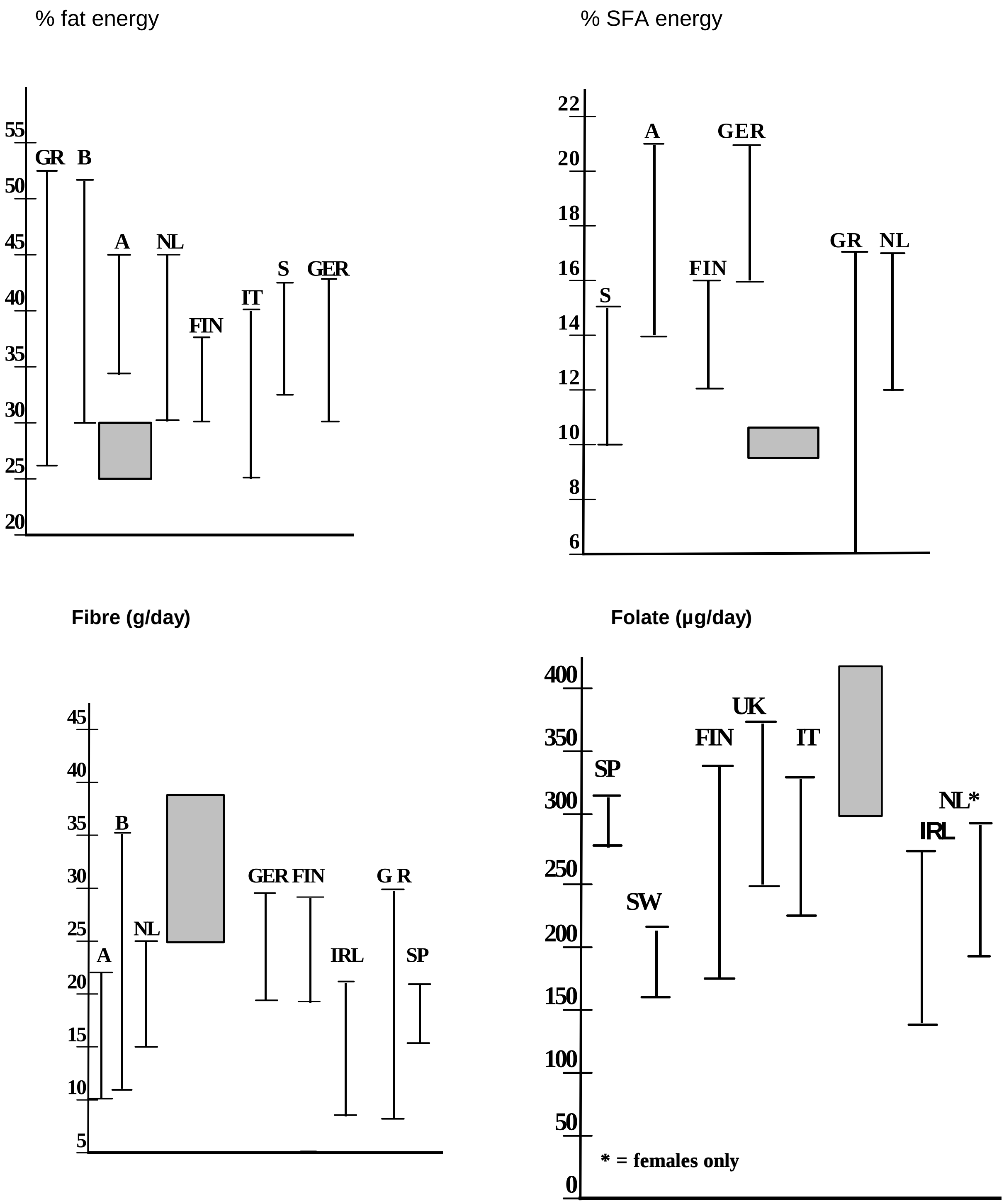
People in the lowest quartile of total fat intake (as % energy) had significantly lower mean intakes of white bread, pasta, red meat, sausages, offal, eggs, whole milk, butter, yoghurt, cheese and biscuits and higher intakes of potatoes, semi-skimmed milk and sweets compared to people in the highest quartile. As well as providing mean intakes among the total population this table (8) also give intakes among consumers only as well as the % consumers of such foods. Such data is useful in exploring the dietary options for developing food-based dietary guidelines by providing information on the numbers in the population consuming various foods and the levels being consumed by them. This enables one to explore whether it would be possible to decrease % consumers of a given food, to decrease the level or amount being consumed or a combination of the two. In the lowest quartile there were fewer consumers of white bread, pasta, cheese, butter, yoghurt, sausages, eggs, sweets and biscuits compared to the highest quartile. Among consumers only of specific foods in the lowest quartile of % fat energy, intakes of potatoes, breakfast cereals, porridge, sweets and sausages were significantly higher while intakes of whole milk, red meat and biscuits were significantly lower compared to those in the highest quartile of % energy fat.

In order to decrease total fat intakes, certain foods can be targeted for food-based dietary guidelines. These include fresh meat, potatoes, cheese, milk, breakfast cereals, sausages and biscuits. Using information in Table 8 on the % consumers and mean consumer only intakes, the following possible options or strategies in relation to the foods above might be recommended (Table 9). Encouraging people to eat less of a certain food may be brought about either through a decrease in serving size or decrease in the frequency of consumption or replacement by a low-fat alternative.

Before any FBDG guidelines may be developed however, consideration must be given to the implications of increasing and decreasing specific foods on what foods are displaced, the possible changes in energy intakes as well as the compatibility of co-existing guidelines. Some examples of potential incompatibility and conflict in FBDG might be: an increase in breakfast cereal consumption with a decrease in milk consumption, an increase in potato consumption with a decrease in butter consumption. Also, a guideline which recommends the reduction in red meat intake to decrease total fat intake may compromise iron intakes (which could be a problem for certain subgroups in the adult Irish population). Perhaps instead of recommending a reduction in red meat intake, a more specific recommendation to eat leaner cuts of red meat may be more appropriate.

Such examples highlight the need to take account of the compatibility of co-existing guidelines. Furthermore, since FBDG should be developed in a specific socio-cultural context, consideration must also be given to relevant social, economic, agricultural and environmental factors affecting food availability and eating patterns.

Figure 1. Range of intakes (mean of highest to mean of lowest quartiles/tertiles) of % fat energy, % saturated fat (SFA) energy, fibre (g/d) and folate (µg/d) in relation to range of member state recommendations (shaded boxes) for these nutrients.



A = Austria; B = Belgium; FIN = Finland; GER = Germany; GR = Greece; IRL = Ireland; IT = Italy; NL = Netherlands; SP = Spain; SW = Sweden; UK = United Kingdom

Table 1. Composition of dietary fat (% w/w) among the lowest and highest quantiles of % energy as fat in selected EU member states.

Quantile	**Lowest**			**Highest**		
	SFA	MUFA	PUFA	SFA	MUFA	PUFA
Country						
Belgium	43	38	19	43	38	19
Finland	47	37	17	48	38	15
Germany	45	40	15	46	39	14
Greece	34	51	15	30	57	13
Netherlands	41	39	19	40	40	20
Portugal	32	48	20	35	47	18
Spain	36	50	14	37	50	13
Sweden	45	38	17	52	33	14

Table 2. Fat (% energy) among those in the lowest and highest quantiles of intake for total fat, SFA, fibre and fruit and vegetables in selected EU member states.

Country	**Fat** % energy		**SFA** % energy		**Fibre** % energy		**Fruit & Vegetables** % energy	
	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest
Belgium	31.0	51.9	-		42.6	40.2	44.2	40.5
Finland	26.3	41.4	27.5	40.2	36.6	29.9	35.5	31.8
Germany	33.2	47.9	34.1	45.6	39.2	39.5	39.6	39.9
Greece	26.9	53.1	31.1	46.6	44.8	36.2	41.2	38.0
Ireland	26.3	37.3	-	-	32.6	31.4	32.2	31.7
Italy	24.9	39.3			33.7	31.1	32.7	32.1
Netherlands	30.1	44.9	31.5	43.1	38.3	35.7	38.5	36.2
Portugal	22.0	34.7	21.9	33.2	-	-	-	-
Spain	33.2	42.2	34.2	41.0	39.5	35.8	38.5	37.0
Sweden	27.0	43.0	29.0	42.0	40.0	31.0	38.0	34.0

Table 3. Mean total population intakes of specific foods or food groups among subjects with low and high intake of fruit and vegetables (g/day) in selected EU member states.

Food	Level	Belgium	Finland	Germany	Greece	Ireland	Italy	Netherlands	Sweden
Fresh meat	Low	105	79	79	45	30	72	106	67
	High	129	85	123	29	53	75	127	77
Processed meat	Low	22	59	91	-	10	30	-	20
	High	23	51	124	-	5	26	-	15
Fruit	Low	29	54	-	28	7	67	22	42
	High	350	206	-	486	195	377	221	237
Vegetables	Low	107	73	-	54	44	132	64	40
	High	317	182	-	401	138	336	215	165
White bread	Low	90	18	172	76	88	96	141	77
	High	68	16	207	109	70	119	150	89
Wholemeal bread	Low	50	77	16	-	36	1	-	-
	High	70	76	21	-	87	9	-	-
Milk (full-fat)	Low	116	52	145	90	325	61	298	360
	High	101	15	176	80	359	53	367	320
Cheese	Low	37	27	32	24	4	38	30	30
	High	44	44	61	34	1	47	36	46
Potatoes	Low	20	134	126	45	183	32	101	99
	High	192	114	192	62	240	43	140	113

In Greece and The Netherlands, fresh meat = all meat including poultry; in The Netherlands, Sweden and Greece, white bread = all bread; in The Netherlands, milk (full fat) = all milk products.

Table 4. Mean intakes of specific food or food groups among sub-groups with low and high intakes of saturated fat (% energy) in selected EU member states.

Country	Level	Cheese	Milk	Bread	Potatoes	Fresh meat	Sausages / processed meat	Fruit	Vegetables	Biscuits & cakes	Chocolate, sugar products	Soft drinks	Alcoholic drinks
Finland	Low	25	285	146	122	75	31	173	148	-	-	56	192
	High	44	341	130	125	88	65	107	119	-	-	68	132
Germany	Low	44	106	179	158	101	95	189	243	35	9	419	782
	High	43	198	188	156	96	109	170	232	55	14	313	258
Greece	Low	7	65	118	68	16	-	341	261	30	-	-	45
	High	59	107	67	34	56	-	138	126	55	-	-	36
Netherlands	Low	21	326	149	106	109	-	129	144	41	44	-	320
	High	45	354	135	134	126	-	96	139	48	35	-	135
Spain	Low	10	66	105	72	64	26	346	221	19	18	62	-
	High	32	184	95	74	109	48	188	205	49	23	86	-
Sweden	Low	26	341	77	107	70	12	188	123	32	-	-	-
	High	46	368	85	109	73	21	97	80	50	-	-	-
UK	Low	20	81	135	90	163	-	117	151	63	118	-	1213
	High	28	193	133	82	185	-	101	129	90	121	-	451

In Greece, The Netherlands and The UK, fresh meat = all meat including poultry; in The UK, cheese = cheese and dairy desserts; values for The UK relate to men only

Table 5. % consumers and mean intakes among consumers with low and high intakes (lowest and highest quantiles) of fruit and vegetables (g/day) in selected EU member states.

Consumers only

		Belgium		***Finland***		***Germany***		***Greece***		***Ireland***		***Italy***		***Netherlands***		***Sweden***	
	Level	**Mean**	**% cons**	**Mean**	**% cons**	**Mean**	**% cons**	**Mean**	**% cons**	**Mean**	**% cons**	**Mean**	**% cons**	**Mean**	**% cons**	**Mean**	**% cons**
Fresh meat	Low	136	77	-	-	79	100	87	52	37	82	77	94	110	96	68	99
	High	154	84	-	-	123	100	134	21	57	93	79	94	133	96	81	95
Processed meat	Low	76	30	70	85	91	100	-	-	17	57	32	93	-	-	24	84
	High	73	32	63	81	124	100	-	-	16	37	31	82	-	-	22	68
Fruit	Low	98	30	68	79	-	-	98	29	21	32	-	-	53	42	54	78
	High	363	97	212	97	-	-	503	97	201	97	-	-	227	97	237	100
Vegetables	Low	124	86	74	98	-	-	84	63	46	94	-	-	77	83	42	96
	High	320	99	183	100	-	-	427	94	139	99	-	-	219	98	165	100
White bread	Low	122	74	40	45	172	100	90	85	107	82	97	99	143	99	77	100
	High	113	59	36	44	207	100	117	93	121	58	121	98	151	99	89	100
Wholemeal bread	Low	136	37	89	86	87	18	-	-	124	29	27	3	-	-	-	
	High	133	53	85	90	109	20	-	-	150	58	79	12	-	-	-	-
Milk (full-fat)	Low	181	64	251	21	146	99	136	66	346	94	125	49	322	93	375	96
	High	176	57	85	17	176	100	156	51	420	85	127	42	383	96	344	93
Cheese	Low	63	59	34	78	33	99	53	45	10	20	38	98	40	75	32	93
	High	67	66	48	92	61	100	76	44	16	49	48	99	42	84	46	99
Potatoes	Low	227	88	140	96	126	100	143	31	194	94	43	71	135	75	103	96
	High	217	88	123	93	192	100	182	34	247	97	56	76	161	87	113	99

Table 6. Examples of some rich dietary sources of fat

Butter, Margarine, Spreads
Vegetable Oils, Dripping, Lard
Nuts (Brazil, Barcelona, Almonds, Peanuts, Walnuts)
Cheese (cream cheese, stilton, Danish blue)
Cream (Double, Whipping)
Pastry (Flaky, Short)
Milk Chocolate
Sardines, whitebait,
French Dressing, Mayonnaise
Wafers, Shortbread, chocolate biscuits (fully coated)
Fried onions
Potato Crisps
Salami, Sausages
Duck, Goose
Lamb
Rashers/Bacon fried

Table 7. The % contribution to total fat intake (% energy from fat) in Irish adults (18 years +)

Food Group	% Contribution
Fresh meat	18
Spreadable fats	17
Milk	16
Biscuits/cakes/pastries/desserts	11
Meat products	7
Potatoes	6
Eggs	5
Bread	5
Other dairy products	4
Chocolate confectionery	2
Savoury snacks	1
	92% of total

Table 8. Mean daily nutrient and food intakes of Irish adults, aged 18 and above, with low and high relative fat intakes (% fat energy)

	Total population			Consumers only				
	Low <29.7%	**High >34.9%**		**Low <29.7%**		**High >34.9%**		
	Mean	**Mean**	**P**	**Mean**	**% cons**	**Mean**	**% cons**	**P**
Energy (kcals)	1959	2321	***					
Protein (% energy)	14.5	14.7	NS					
Carbohydrate (% energy)	57.9	48.5	NS					
Alcohol (% energy)	3.1	1.5	NS					
Total fat (% energy)	26.3	37.3	***					
Fibre (g/day)	18.0	18.2	NS					
Fibre (g/MJ)	2.3	1.9	*					
(g/day)								
Brown bread	59	54	NS	39	151	42	127	NS
Rice	6	5	NS	13	47	14	37	NS
White bread	61	87	***	59	104	79	109	NS
Potatoes	271	166	***	94	288	97	171	***
Pasta	1	4	*	7	17	15	26	NS
Porridge	21	15	NS	18	114	17	88	*
Breakfast cereals	41	37	NS	66	63	74	49	**
Whole milk	255	418	***	81	313	94	445	**
Semi-skimmed milk	47	30	*	13	345	6	482	NS
Cheese	4	6	**	22	20	38	16	NS
Margarine	4	5	NS	25	17	28	16	NS
Butter	8	12	*	49	16	60	20	NS
Yogurt	16	20	*	22	69	37	54	NS
Red meat	35	45	**	82	43	91	49	*
Meat products (bacon)	16	16	NS	70	23	75	21	NS
Sausages	5	7	*	36	14	64	11	*
Poultry	24	24	NS	58	41	62	38	NS
Offal	1	2	*	4	17	9	26	NS
Eggs	19	26	**	54	34	71	36	NS
Fish	15	18	NS	61	25	61	29	NS
Savoury snacks	2	5	*	18	12	34	14	NS
Sweets	14	5	**	18	75	28	19	*
Biscuits	9	23	***	39	22	64	36	**
Fruit	84	76	NS	70	120	74	103	NS
Vegetables	103	88	NS	99	104	98	90	NS

Table 9. Possible options for FBDG to decrease fat intakes (fat energy %) among Irish Adults (n-715)

Food Group	% consumers	*Intakes among consumers*
Whole milk	decrease	decrease
Breakfast cereals	-	increase
Fresh meat	decrease	decrease
Sausages	decrease	-
Biscuits	decrease	decrease
Sweets	decrease	increase
Potatoes	decrease	increase
White bread	decrease	-

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