Food and health data

Their use in nutrition policy-making
The World Health Organization is a specialized agency of the United Nations with primary responsibility for international health matters and public health. Through this Organization, which was created in 1948, the health professions of some 165 countries exchange their knowledge and experience with the aim of making possible the attainment by all citizens of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life.

The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health problems of the countries it serves. The European Region has 31 active Member States, and is unique in that a large proportion of them are industrialized countries with highly advanced medical services. The European programme therefore differs from those of other regions in concentrating on the problems associated with industrial society. In its strategy for attaining the goal of “health for all by the year 2000” the Regional Office is arranging its activities in three main areas: promotion of lifestyles conducive to health; reduction of preventable conditions; and provision of care that is adequate, accessible and acceptable to all.

The Region is also characterized by the large number of languages spoken by its peoples and the resulting difficulties in disseminating information to all who may need it. The Regional Office publishes in four languages — English, French, German and Russian — and applications for rights of translation into other languages are most welcome.

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Food and health data

Their use in
nutrition policy-making
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Edited by

W. Becker
and
E. Helsing

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Health policy-making is receiving more serious attention in Europe than ever before. At the same time, the concept of health has been widened, first from solely curative health care to include preventive activities for both individuals and populations, and then to embrace the promotion of health. This in turn has broadened the range of sectors concerned with health. Makers of policies on topics as diverse as city planning and agriculture, for example, must now put health on their political agendas.

In this situation, it is not surprising that food and nutrition policies should draw the attention of health planners. Six European countries have made parliamentary decisions to have food and nutrition policies: Norway in 1975, Denmark and the Netherlands in 1984, Finland in 1985, Malta in 1988 and Iceland in 1989. Several countries may be on the verge of adopting such a policy; Hungary, Poland and Sweden have laid much of the groundwork.

The establishment of a food and nutrition policy usually requires the formulation of objectives for desirable changes in the diet of the population. This in turn presupposes that clear and accurate pictures can be drawn of the population's dietary pattern and diet-related health (or disease) pattern. These are needed to indicate where changes ought to take place.

Data on the dietary patterns of populations can be obtained from several sources. Food balance sheets, household budget surveys and individual-level studies, as well as mortality statistics, are widely available, although the quality of the information they give is seldom assessed. The present volume is intended to fill this gap, to provide a critical assessment of data sources, so that food and nutrition policy-makers may use them with greater confidence.

A 1988 publication, Healthy nutrition: preventing nutrition-related diseases in Europe (WHO Regional Publications, European
Series, No. 24), described the importance of nutrition policy-making. Taking the next step, the present volume is intended to be useful in the setting of objectives for food and nutrition policies. It may in turn be followed by examples of such policies in action. We in the Regional Office for Europe hope that this work may help Member States in the effort to secure a more healthy diet for future generations, and thus contribute to the achievement of health for all.

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Use of a nutrition information system

E. Helsing

This publication is aimed at nutrition policy-makers. Who are these people and what is nutrition policy? This chapter tries to give an answer and to show how nutrition policy-makers can use existing data sets to make policy.

Nutrition policy has been defined in many ways; the simplest definition (1) used by WHO, reads: “Nutrition policy is a food policy that explicitly takes health promotion into consideration.” According to such a definition, anyone who is involved in food policy-making — anyone who makes decisions about a population’s food supply and does so with the explicit additional objective of systematically promoting health — qualifies as a nutrition policy-maker. This category, then, includes food producers and manufacturers, officials in ministries of agriculture, industry, trade and health, and individuals in positions that entail decision-making on food such as caterers, hospital administrators and food importers and retailers. Clearly, many people have the potential to contribute to a nation’s nutritional wellbeing.

If these potential policy-makers want to make such a contribution, they need two things: a clear idea of what the population ought to be eating and an equally clear idea of what is eaten and by whom. Information to meet the first need has appeared elsewhere (2). Satisfying the second need requires a food and health information system or, more simply, a nutrition information system (3,4).

It is easy to ask what people eat, but finding an answer can be a daunting task. For one thing, people do not eat the same food every day or week, or throughout the year or their lives. Second, every person has different needs and meets them in a different way from other people. This enormous variability makes it very difficult to
simplify data collection by, for example, grouping people according to age, sex or even body size.

Further, so many foods of such differing composition are available in most European countries that a mind-boggling amount of information is needed to get a true picture of a population’s actual food consumption. A well stocked European supermarket may have 12,000 different foods available at any time, 1200 of which change every year. Keeping track of this is a tough job. Still, food consumption studies of individuals are being made. Such studies commonly take a long time to plan, to carry out and to analyse. If the aim is to get a sample of people that is representative of the population, the amount of data collected is usually great indeed. Such studies therefore cannot be carried out very often; most countries do not have the resources to perform them at intervals of less than five to ten years.

Nevertheless, information on food supply and consumption and on health is routinely collected, at regular and shorter intervals, for purposes other than nutrition policy-making. This information also gives a picture of health and of food consumption trends, although it may describe not food consumption in the sense of intake but, for example, food supply or food purchases by a household, or health in the form of mortality statistics. These data are collected for the making of policies on agriculture, health or economics, to be sure, but they are still useful tools for people who want to help a population eat well.

**Purpose of This Book**

This publication describes the available sources of data on food and health in a critical way, assessing their usefulness for nutrition policy-makers. The basic tenet is that any data set can be used, provided the user knows how the data were collected and treated and thus what they do and, more important, do not say.

A critical attitude towards the use of data therefore permeates this publication from Chapter 2, which outlines the quality requirements of data for nutrition policy-making, through Chapters 3–5, describing the origin of data on health, food supply and household-level food purchases, respectively. The main advantage of all these sources is that the data are collected regularly for special purposes and are available to the nutrition policy-maker on a sustained basis. They

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\[a\] G. Rothe, Irma A/S, Denmark (personal communication).
point out trends and allow comparisons between groups and sometimes countries. Still, maintaining a critical attitude when making these comparisons is most important.

An additional aim of this book is to describe some of the experience gained by people who have used such data. Chapter 6 describes methods used in food consumption studies of individuals. Chapter 7 gives some ideas about difficulties in food-to-nutrient conversion. Chapter 8 presents an innovative concept of special data banks to be used to convert food supply and household-level data to data on nutrient intake.

Chapter 9 discusses some of the caveats that have to be borne in mind when using various data sources. A number of examples illustrates not only their variability and inconsistency but also their remarkable consistency. The authors hope that this book will help readers to understand the problems and possibilities in the use of the data described. Finally, Chapter 10 re-emphasizes the connection between diet and health by showing how data should be used cautiously in assessments of the quality of a population’s diet (by measuring consumption against physiological nutrient requirements).

The authors do not envisage the use of the data sources described here for research. The degree of accuracy necessary scientifically to establish causality or relationships may not be necessary in policy-making. In reality, policy-relevant decisions about food, at least, are often made without using any health- or nutrition-related data. Such data, however, are used in market surveys undertaken by food manufacturers.

The Use of a Food and Health Information System

Five phases in the process of nutrition policy-making may be distinguished, in each of which data on food and health in a population are important:

— advocacy;
— the formulation of overall objectives, based on an analysis of food and health problems;
— planning strategies;
— monitoring the effects of actions undertaken, during implementation; and
— the evaluation of end results, possibly leading to changes in objectives.
Advocacy

Nutrition policies are a relatively new phenomenon in Europe, although all countries in the Region have food policies dealing variously with the production, manufacture, provision, and import and export of food. In the past, the policies made by different sectors have not necessarily been linked, and have usually been designed and implemented without consideration of their possible effects on health.

In a nutrition policy, however, these sectoral policies constitute a set of concerted actions whose aims include the maintenance or improvement of the health of the consumer. Politicians do not necessarily feel the need to embark on this type of complicated, intersectoral policy-making. Here advocacy becomes necessary and the need for a nutrition information system emerges.

Nutrition is a science in which many people feel they have a certain expertise, since everyone eats several times every day. People's notions about many aspects of their diet, however, are often not very scientific. Ordinary people often say that they are eating just as they did 10 or 20 years ago. Politicians and policy-makers are usually ordinary people when it comes to food beliefs; they commonly feel that their own diet, and thus the accepted national diet, although perhaps not ideal, is in some kind of steady state.

A nutrition information system based on food supply data shows that this is not the case in any European country. The changes in a national diet are considerable when they are seen over a period of time (Fig. 1).

The changes in national diets in Europe were particularly pronounced after the Second World War, when the European economy first recovered and then expanded, food production burgeoned and there was enough food for everybody. For the first time in the history of the European Region, almost all its peoples could afford to eat festive food every day, and they promptly did so. In many countries, what had previously been luxury food items — meat, eggs and dairy products — took the place of traditional staple foods such as cereals and potatoes, which became accessories. Food balance sheets show that, in the period 1950–1980, the consumption of cereal in southern Europe and potatoes and cereal in the north declined steadily. At the same time, meat and milk consumption increased all over Europe, sometimes two- or threefold.

Such information can be used to dispel the myth of the stability of food patterns that prevails among policy-makers and others. While no nutrition policy advocate would wish to impose a dietary pattern on any consumer, it is important to know that diets have always changed over time, often radically, and that health considerations have only rarely contributed to these changes.
Fig. 1. Changes in the supply of cereals and meat in Greece and Norway (per caput, per year), averages over five-year periods.


dictated by such factors as agricultural policy considerations, the availability of food technology and import and export opportunities and constraints.

Six countries so far have formulated and implemented specific nutrition policies: Denmark in 1984, Finland in 1985, Iceland in 1989, Malta in 1988, the Netherlands in 1984 and Norway in 1975. An important political rationale for these actions was an awareness of radical dietary changes and the adverse health effects they entailed. These changes were documented by national data on diet and, in some cases, diet-related disease. The nutrition policy documents in the Netherlands (5) and Norway (6) quote some of these figures directly. In Denmark, although the figures were not included in the document (7), they were frequently cited in the period leading up to the adoption of the policy.
Experience from countries where nutrition policies are being formulated, such as Sweden, Hungary, Iceland and Poland, also shows the necessity of data from a nutrition information system in this period. Trends in nutrition-related conditions (cardiovascular diseases, cancer, obesity, diabetes and osteoporosis, to name but a few) are sometimes presented alongside data showing trends in food consumption. In some cases, these data presentations are quite striking, as are those from Norway (Fig. 2) and Poland (Fig. 3). In spite of political uncertainty and most probably an increased level of stress in those periods of food scarcity, cardiovascular disease mortality decreased in both countries, only to increase again when times improved and the food supply went back to normal.

The food-related sectors may vary in their interest in a coordinated approach. Using data to show changes in food supply and health may be the most striking way to convince people in these sectors that they will benefit by replacing an uncoordinated food policy with a coordinated nutrition policy. Providing a clear picture of the situation, preferably in an international context, can have a powerful effect and may put sectoral interests into a wider perspective.

Formulation of objectives
Having a set of clearly defined goals eases the task of making nutrition policy for all involved. Such goals are particularly useful for nutrition educators, food producers, agriculture policy-makers, and food manufacturers and traders.

Such goals are first set on a nutrient level. Almost all countries in the European Region already have what are called recommended dietary allowances for most nutrients. In addition, the Regional Office for Europe has collated and presented European nutrient goals (2).

Since food policy planning takes place at the level of foods, however, nutrient goals must be translated into goals at the level of foods. These food-level goals are usually established for different groups of foods that are considered to be important for health, mainly in the form of projections of 10–15 years. The existing food supply pattern is the point of departure; projections can then be made, based on broad calculations, of how the pattern should change to promote good health. Such overall food-level objectives have to be developed jointly by agriculture, health and nutrition policy-makers and in collaboration with the food industry.

In planning how to model the food supply in the future, nutrition policy-makers will need information from the nutrition information system. If one goal is, for example, to lower the intake of saturated
Fig. 2. Mortality from cardiovascular diseases and fat consumption in Norway, 1938–1948

Deaths from cardiovascular diseases per 10,000 population

Cardiovascular diseases

Fat consumption (kg per head)

Year

1938 1940 1942 1944 1946 1948

Fat

17
15
13
11
9

Source: Strøm & Adelsten Jensen (8).

fats, many questions must be answered. What is today’s intake and what is a desirable goal? Where does the saturated fat in the diet come from and where can it most realistically be cut? What are the consequences for the producers and manufacturers of foods?

The establishment of food goals may take a long time and much effort, and perhaps involve the definition of alternative strategies for
Fig. 3. Ischaemic heart disease mortality and total fat, tobacco and alcohol consumption in Poland, 1960–1985

Source: Szostak & Cybulskia (9).

attaining the goal. The dialogue with the producers and manufacturers concerned should be maintained, and compromises may have to be made. Table 1 shows the example of the "fat profile" for Malta, established specifically for such a discussion. Maltese nutrition policy-makers used the profile in discussions with food traders and others. Subsequently, since Malta imports much of its food, it was not difficult for importers, when they were presented with the overall goal of lowering fat consumption, to select low-fat foods (10).

When setting such concrete goals for future changes in the food supply, it is important to avoid symbolic gestures that look good but are without practical consequence. In one country, for example, reducing the fat content of sausages by 20% was seen as a valuable contribution to lowering the fat intake of the population. With the nutrition information available, however, it was easily shown that this measure would save only around 100 g of the total of almost 40 kg of fat consumed per person per year. A nutrition information
Table 1. The “fat profile” of the Maltese diet: percentage contribution to total dietary fat from some food sources

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<thead>
<tr>
<th>Source</th>
<th>Fat (grams per head per day)</th>
<th>Percentage of total dietary fat</th>
</tr>
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<tr>
<td>Meat:</td>
<td></td>
<td></td>
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<tr>
<td>rabbit</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>beef</td>
<td>11.6</td>
<td>7.9</td>
</tr>
<tr>
<td>pork</td>
<td>4.2</td>
<td>2.8</td>
</tr>
<tr>
<td>other</td>
<td>3.8</td>
<td>2.6</td>
</tr>
<tr>
<td>Fresh fish</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Eggs</td>
<td>20.7</td>
<td>14.0</td>
</tr>
<tr>
<td>Dairy products:</td>
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<td></td>
</tr>
<tr>
<td>milk</td>
<td>4.8</td>
<td>3.3</td>
</tr>
<tr>
<td>evaporated milk</td>
<td>7.4</td>
<td>5.0</td>
</tr>
<tr>
<td>cheese</td>
<td>15.3</td>
<td>10.4</td>
</tr>
<tr>
<td>Bread</td>
<td>8.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Edible fat</td>
<td>1.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Butter</td>
<td>13.7</td>
<td>9.3</td>
</tr>
<tr>
<td>Margarine</td>
<td>13.4</td>
<td>9.1</td>
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<tr>
<td>Oil</td>
<td>36.3</td>
<td>24.6</td>
</tr>
<tr>
<td>Nuts</td>
<td>3.9</td>
<td>2.6</td>
</tr>
<tr>
<td>Other</td>
<td>1.6</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>147.6</td>
<td>100.0</td>
</tr>
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Source: Bellizzi (10).

system is thus invaluable for the establishment of rational goals for nutrition policy.

Some countries have opted for setting health goals, such as the lowering of diet-related risk factors or mortality from specific diseases in the population. This approach is important but such indirect variables offer a less concrete frame for action than food-related goals. Eventually, of course, both kinds of goal aim for the same result: the changes in dietary pattern should lower risks and morbidity and premature mortality.

To summarize, three concepts have been used to describe objectives for nutrition policies. First, nutrient goals, established by nutrition scientists, are recommendations for the distribution of energy sources in the diet and desirable levels of dietary components such as fibre and salt. Second, food goals based on nutrient goals, are established jointly by agriculture, trade and health policy-makers, for planning at the population level. Third, health goals are based on
specific information on existing patterns in nutrition-related health conditions and a realistic expectation of the results of following nutritional recommendations. In addition, policy-makers may wish to convey their plans to the population through dietary guidelines established by trained nutritionists on the basis of nutrient and food goals. Such guidelines are formulated in a way that people can understand and act on.

Planning strategy
When the goals of the nutrition policy (for both nutrients and their conversion into food) are clearly established, the most effective measures to attain them may be determined. Such measures are likely to differ between countries, depending on factors such as traditions, political feasibility and social conditions. Some measures, however, are likely to prove very potent in almost all countries.

First, agricultural policies are of basic importance; the consumer's choice of foods is limited to what is available on the market, which in turn depends on what is produced and imported. In other words, the effects of nutrition education are limited by the availability of commodities. When food production becomes an end in itself and agricultural policies do not take account of the physiological limitations of the people who compose the market, however, stocks of food that the market cannot absorb may start to pile up. This is what happened in the case of the Common Agricultural Policy of the European Community. Learning to model agricultural production in accordance with human health and physiology serves the interests of producers and consumers and should lead to fewer problems with the storage of unsaleable food.

Food pricing is closely linked to agricultural production. Many countries support their farmers through some kind of subsidy for the food production process. This has consequences for food prices. In general, health is not taken into consideration when subsidies are determined. For example, a northern European country launched a large campaign for nutrition education and physical exercise, planned by nutrition professionals and the food industry. The government, however, simultaneously provided subsidies for the production of meat, milk and cheese, precisely the commodities whose consumption the campaign was attempting to decrease. For this and other reasons, the campaign had a negligible effect on the overall dietary pattern in the country. Neighbouring countries, with somewhat more coherent food and health policies, showed greater eventual changes in mortality from diet-related diseases.

Educating the market — the consumers — about healthy eating must accompany the planning of food production with health in mind.
Nutrition education is therefore an important measure. The content of nutrition education should reflect the overall nutrient and food goals established, and be spelled out in dietary guidelines. These, too, must be based on the nutrition information system, on facts showing who eats what and the target groups for dietary change.

Nutrition education has a deservedly bad reputation, as it is often tailored for the converted and not very efficient in convincing people who really need to change their dietary patterns. The fact that nutrition educators have usually been most successful in reaching people of the same educational level and social class as themselves deserves some reflection.

The labelling of foods is another important measure for change, and may be seen as an extension of nutrition education. As more and more foods are processed and packaged, and thus no longer easily identifiable, consumers have to rely on manufacturers’ descriptions. The better educated the consumer, the more precise can be the information, again enabling the consumer to make an educated choice. Since consumers are now more health-conscious than ever, food choices are often made on health grounds. Manufacturers need to be aware of what the consumer is going to demand, so as to model nutritional labelling to meet the information requirements of the market. As the people who formulate the health message to consumers, nutrition policy-makers may have an important impact on the market.

Another noteworthy area for nutrition policy action is mass catering. As another result of modern lifestyles, more and more people in most countries eat outside their homes, in institutions, canteens or other establishments. Regrettably, the nutrition information systems that provide data on a regular basis, the food balance sheets and the household budget surveys, cannot give information about this important aspect of nutrition policy. Special surveys, however, show that in both size and pervasiveness mass catering is especially important for nutrition policy implementation. With relatively little effort, much can be achieved almost without anybody noticing (11).

In choosing strategies for nutrition policy, the policy-maker always needs to have many options and to work with a variety of sectors. Nutrition policy is a truly intersectoral effort, in which all sectors try to achieve a common overall goal.

Monitoring of effects during implementation
During the implementation of nutrition policy, continuous monitoring (process evaluation) is necessary for economic as well as health reasons. The various actors want to know whether their contributions
affect the population’s dietary pattern and health. Does the price policy lead to changes in consumption? Has the educational message had any effect? If the dietary pattern has changed, what has happened to health? The implementation phase of nutrition policy allows and indeed requires the adjustment of actions, changes in priorities and experimentation with new ideas. A nutrition information system has a vital part in this phase: providing relatively rapid feedback to policy-makers. Data should be made available without too much delay, and there should be some possibility for disaggregation of the information to give as much detail as necessary.

Final evaluation
At some stage, a final evaluation of achievements and results must be made. This kind of evaluation can have advocacy value; it can show whether the nutrition policy was useful and whether its goals were achieved, particularly in the area of health. The final evaluation thus provides the basis for the next round of nutrition policy work. A nutrition policy — like any other sectoral policy — is never completed, but is a part of continuous public policy-making.

Conclusion
A nutrition information system is one of the legs on which a nutrition policy stands, the other being clearly formulated objectives for foods and nutrients. These prerequisites for nutrition policy-making are interdependent; objectives for what people ought to eat cannot be set without clear ideas about what people actually eat at present. This, then, is the first step on the long road towards coherent and comprehensive nutrition policies that will contribute to health for all by the year 2000, and perhaps before.

References


Nutrition information systems
and data quality requirements

A. Kelly & W. Becker

A nutrition information system can be described as a decision support system for use in nutrition policy-making. Such a system works (1):

by observing, analysing and reporting regularly on a wide range of variables indicative of food consumption, nutritional status and health impact. Such information then provides an empirical basis for decision-making and policy planning.

The process consists of the continuous collection, analysis, dissemination and use of data. The focus is entirely pragmatic; it is aimed at meeting the requirements for planning and policy-making.

Four types of nutrition information system may be distinguished. These include systems designed for medium- to long-term policy planning, to act as early warning systems, as part of programme planning and evaluation, and to support advocacy.

Existing systems in developing countries — totalling about 24 in 1988 — are primarily designed for medium- to long-term planning. A few systems were designed for early warning, but they have certain difficulties in providing feedback rapidly enough to be of practical use. In addition, a small number of nutrition surveillance systems was designed for programme planning and evaluation. The advocacy-oriented type was launched by a United Nations interagency initiative in 1988.

In designing an information system, the characteristics of the strategic planning that will influence its structure and composition have to be considered. How the data are to be used in decision-making determines the requirements for their quality.

Different types of data are appropriate to the various stages of the planning process. This should be considered in advance. Further, the information to be supplied by a nutrition surveillance unit to users
should be described in advance as far as possible, so that each knows what to expect.

Considerations in the Use of Data in Nutrition Planning

The terms data and information are generally used loosely and interchangeably, and thus imprecisely. Clarification is required. Information is data that have been processed into a form that is meaningful to the recipient and is of real or perceived value in current or prospective actions or decisions. The relation of data to information is that of raw material to finished product. The simple analysis of data is insufficient to produce information. The term information implies actual or potential use in decision-making.

To summarize, the responsibility of a surveillance unit is to ensure that appropriate data are identified, captured and properly analysed and interpreted, and that valuable information is extracted, synthesized, and presented in a compelling manner.

What is meant by appropriate data and information has yet to be considered. Härö (2) finds that information available for policy guidance is rarely comprehensive or completely relevant. The producers and users of information often fail to comprehend each other’s requirements and problems, which results in mutual dissatisfaction. While producers and analysts argue for more data and cautious interpretation, users are obliged to seek answers based on the limited and possibly inadequate information available.

Good data are expensive, and policy-makers have to balance the need to know with the need to act. Which data should thus be collected? How accurate, timely and detailed need they be? In answering these questions, it is essential to bear in mind that the focus is entirely on data and information required for policy guidance, not for strictly scientific purposes. This pragmatic view leads to the following propositions:

— reliance on imprecise (although not inaccurate) data is better than reliance on no data at all;
— the better the quality of the data, the better the potential of the information system;
— confidence in the decision-making process depends on confidence in the quality of the input to the system; and

Although this chapter deals mainly with food, most of what is said about food data also applies to data on energy and nutrients.
— knowledge about the database — its strengths and weaknesses — is necessary for the user and decisive for the way the information is used.

Data Quality

Data quality is determined by factors such as relevance, precision, accuracy, timeliness and the formulation of the resulting information. Precision and accuracy are dealt with in standard works on statistics and epidemiology. Only their implications for a nutrition information system are considered here.

Relevance
Ideally, data and the resulting information are designed to cater for the needs of the user. This results in an efficient and effective information system. In practice, particularly when nutrition objectives and strategies have not been fully defined and the system is primarily designed to support advocacy and therefore to collect rather general data, neither efficiency nor effectiveness can be expected to be optimal. Still, findings must, whenever appropriate, be characterized in precise terms (that is, by age, sex, region and income) to enable, for example, problems to be defined, strategies to be made and activities to be selected.

Precision
The use of large samples tends to produce more reliable findings, but as a function of increased cost. Essentially, measurements of variables must be geared to meet users’ needs for precision. A high degree of precision is rarely crucial to decision-making, and certainly not to strategic planning, for which order-of-magnitude estimates suffice. Precision is not at issue for data sets that are effectively censuses, such as food balance sheets and national morbidity and mortality rates or other countrywide vital statistics. It is clearly applicable in survey work and longitudinal studies, such as household budget surveys or dietary surveys.

Accuracy
Inaccurate or biased estimates may result from faulty definitions, incomplete data or poor technique. Like precision, accuracy is related to cost. Thus, only the degree of accuracy necessary for the user to be able to reach a decision is required. Planners are unlikely at first to know this in advance, but it should become obvious to them with experience.
The control of precision and accuracy is only possible for studies undertaken by a surveillance unit, or in circumstances in which the unit has some influence on the agency responsible for the collection of the data set. Each of the core data sets (Fig. 1) is subject to some form of inaccuracy. Attempts must be made to understand these weaknesses and to quantify, if at all possible, the direction and magnitude of known errors.

**Timeliness**
In the world of business, information that is completely up to date is crucial to success. For strategic planning, this need is less acute. Measuring the present level of a parameter is usually of less interest than establishing how it changes with time. Excluding ad hoc studies, whose results may be available within a short time, official statistics may be from one to several years out of date. This does not necessarily negate the value of the available data, however, as change may occur slowly, over decades.

**Fig. 1. Primary sources of data for a nutrition information system**

**Food chain**

- Food supply system
  - Food balance sheets

Food consumption system

- Household surveys
- Dietary surveys
- Food prices

Health Impact

- Mortality data
- Morbidity data
- Anthropometric data
- Birth weight data
- Infant feeding practices

*Source: Kelly (1).*
Appropriate formulation
The value of information depends on clear presentation in a form that is concise, understandable and useful to policy-makers. Appreciating what is useful may be a problem in the early phase of nutrition policy-making, when the term should be interpreted very liberally. Clarity is enhanced by the judicious use of illustrations.

The appropriate presentation of results requires the determination of the results to be put forward, their audience and their purpose. Three separate purposes may be distinguished — to stimulate, to persuade or to inform — and each may be governed by different principles of design. Useful guidance may be derived from Schmid (3) on the use and misuse of graphics and Chapman (4) on the creation and interpretation of tables.

A number of misconceptions arise about data quality when data producers, data analysts, scientists and policy-makers interact. Statisticians and scientists are accustomed to expecting, even demanding, the highest quality before reaching conclusions. While it is incumbent on them to improve the information database whenever necessary, they must also appreciate when data of lesser quality will serve the needs of decision-makers.

Knowing the Sources of Dietary Data

Different types of dietary data are available, and it is important to know how data are to be treated and what information they can actually give before they are used in decision-making, the planning, evaluation and adjustment of programmes, and education.

Several important points must be clear to the user of dietary data (5):

— the method and level of data collection;
— the food included;
— the degree of processing of the food;
— how the food is grouped.

Methods and level of data collection

The methods used for collecting data on diets differ in the kind of information they give and the detail and precision of the data. In principle, dietary data can be collected at three levels (Fig. 2).

Dietary data at the national level give information on what and how much food is available for human consumption in one year. They say nothing about the actual consumption by individuals or about the distribution of food between different groups.
The national supply available for human consumption is calculated in food balance sheets. These are collected and published for most countries of the world by the Food and Agriculture Organization of the United Nations (FAO) and also by the Organisation for Economic Co-operation and Development (OECD) for its member countries. In addition, many countries publish national food balance sheets. These sources may give significantly different information (see Chapter 9).

Dietary data at the household level give information on household purchases of food in terms of expenditure and/or amounts. No information is given on how food is handled within the household or on actual consumption. Data on food bought outside the household, or consumed in mass catering, are often not included.

Food available at the household level, as purchased or consumed, may be estimated by national household budget surveys or the more specialized household consumption surveys. Household surveys may not include consumption outside the home, which is increasingly
important, or various snack foods. Data from household surveys may therefore underestimate the amount of food available to the family for consumption.

Dietary data at the individual level give information on the actual consumption of food by individuals or groups (see Chapter 6). Here, data refer to food as it is eaten, and additional information on meal patterns and food preparation methods can also be obtained.

Before any of these data are used, the population sample and the time period covered should be made clear to the user, along with the criteria used for sample selection and the characteristics of the final sample (such as sex and age).

Waste occurs between production and consumption, so the average amount of food available for each person diminishes. In addition, because food is processed differently at different levels, dietary data from these levels are not directly comparable. Data on sugar, which are discussed in detail in Annex 1, provide a good example.

What food is included?
Naturally all the types of food that are consumed cannot be included in the data. Water, salt and spices, for example, are usually missing, as are vitamin and mineral supplements, which are not always regarded as food. Data on coffee, tea and alcoholic drinks may not be included.

A food or drink might be excluded because obtaining data for it with a particular method or at a particular level is difficult or impossible. In addition, certain types of food or drink may be excluded because they are considered to be unimportant to nutrition or health. In production and importation statistics, for which data on different products are collected from different sources, products that are rare or have little economic importance may be omitted. In general, data collected from different levels and sources must be assumed to differ in the inclusion and grouping of foods. Such differences may also be due to the objectives of the data collection.

Degree of processing
Most commodities are processed, often several times, before they are eaten. Processing can include sorting, the removal of inedible parts (refuse), treatment to increase shelf-life (such as cooling, freezing and preservation), the processing of composite foods and the preparation of dishes and meals.

Processing leads to weight changes, due to removal of refuse or changes in water content, for example. Fish can be recorded in a number of forms. When bread is made from flour, the weight of the product increases, while the weight of fish and meat decreases during
boiling or frying. The production of different food items and the preparation of dishes lead to a larger assortment and the mixing of foods from different groups. The degree of processing is thus an important consideration in the use of data on food (Table 1).

### Table 1. The degree of processing of foods reported at national, household and individual levels

<table>
<thead>
<tr>
<th>Food</th>
<th>National</th>
<th>Household</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>Whole fish</td>
<td>Headless and gutted fish, fillets and fish products</td>
<td>Prepared dishes</td>
</tr>
<tr>
<td>Meat</td>
<td>Carcass</td>
<td>Cuts and meat products</td>
<td>Prepared dishes</td>
</tr>
<tr>
<td>Cereals</td>
<td>Flour or grain</td>
<td>Flour, bread, cakes and breakfast cereals</td>
<td>Bread, porridge, cakes and flour-containing dishes</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Potatoes</td>
<td>Potatoes and potato products</td>
<td>Boiled or fried potatoes, potato dishes and snacks</td>
</tr>
<tr>
<td>Edible fats</td>
<td>Butter, vegetable oils, animal fats</td>
<td>Butter, margarine, vegetable oils and dressings</td>
<td>Butter, margarine, and vegetable oils as such or in dishes</td>
</tr>
</tbody>
</table>

### Aggregation of food

Owing to the large number of food items on the market, foods must usually be grouped. There is no standardized system for this. In data from various sources and levels, differences can be found in how food is grouped, how well it is specified and the degree of detail provided. The names of similar groups of food can also differ between data sets.

The main groups normally used (such as cereals, meat, fish and vegetables) are based on the type of food included. Potatoes may be grouped as a vegetable, or as a root vegetable with other roots and tubers. Double reporting may also occur. As shown in Table 2, milk and milk products and the products in the fats and oils group may differ considerably between sources (6–8).
Table 2. The composition of two food groups in food balance sheets from three sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Milk and milk products</th>
<th>Fats and oils</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAO</td>
<td>Whole milk</td>
<td>Margarine</td>
</tr>
<tr>
<td></td>
<td>Skim milk</td>
<td>Vegetable oil</td>
</tr>
<tr>
<td></td>
<td>Fresh whey</td>
<td>Butter</td>
</tr>
<tr>
<td></td>
<td>Fresh cream</td>
<td>Other fat</td>
</tr>
<tr>
<td></td>
<td>Cheese</td>
<td>Demersal liver oil</td>
</tr>
<tr>
<td>OECD</td>
<td>Whole milk and products</td>
<td>Butter</td>
</tr>
<tr>
<td></td>
<td>Skim milk and products</td>
<td>Vegetable oils and fats</td>
</tr>
<tr>
<td></td>
<td>Condensed whole milk</td>
<td>Oils and fats from marine animals</td>
</tr>
<tr>
<td></td>
<td>Condensed skim milk</td>
<td>Fats and oils from land animals</td>
</tr>
<tr>
<td></td>
<td>Dry whole milk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry skim milk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cheese</td>
<td>(all data expressed in terms of pure fat)</td>
</tr>
<tr>
<td>Swedish food balance sheets</td>
<td>Whole milk</td>
<td>Butter</td>
</tr>
<tr>
<td></td>
<td>Low-fat milk</td>
<td>Margarine</td>
</tr>
<tr>
<td></td>
<td>Fermented milk</td>
<td>Minarine</td>
</tr>
<tr>
<td></td>
<td>Coffee cream</td>
<td>Bakery margarine</td>
</tr>
<tr>
<td></td>
<td>Whole cream</td>
<td>Bakery oil</td>
</tr>
<tr>
<td></td>
<td>Cheese</td>
<td>Vegetable oil</td>
</tr>
</tbody>
</table>

Source: FAO food balance sheets, 1979–81 average (6), OECD food consumption statistics 1973–1982 (7) and Lindblad (8).

It is not self-evident to which group a particular food should belong. The more processed the food, the more food groups overlap. For example, about half of the plain sugar (produced and imported) available in Sweden is in the form of various processed products when it reaches retail level.

When all these factors are considered, the differences between the figures reported are not surprising.

Specificity
What does the degree of specification mean when a set of data is used? Tables with figures for food groups are comprehensive and appear to be simple to use. Simplification has its price, however; the inclusion of all commodities within a few main groups requires the combination of commodities that may be different in composition, use and
price. If the trends in food supply are to be studied or data from different population groups compared, differences in the number and composition of food groups must be borne in mind.

References


5. Eggen Ogrim, M. Kilder til viten om norsk kosthold [Sources of information on the Norwegian diet], 2nd ed. Oslo, Landsforeningen for Kosthold og Helse, 1983.


Health impact monitoring

K. Test

How is health impact monitoring useful to nutrition policy-makers? In epidemiological terms, the word impact in this phrase implies monitoring health status so as to have an effect on improving health in a population. Having an effect requires acting on one or more of the factors responsible for poor health, thereby maintaining a healthy population. This chapter does not attempt to cover the whole field of epidemiology, the subject of many textbooks. It focuses on health monitoring in relation to possible dietary causes of disease and potential policy decisions on dietary modification. What relevant data can be obtained on causes of death and disease? How are they currently being used in surveillance? What are their limitations?

Three major types of noncommunicable disease in Europe — cardiovascular diseases, cancer and diabetes — are discussed, in so far as they are relevant to decisions on dietary intervention.

In this context, three situations should be considered in monitoring a population's health. The first is the ideal, in which the causal link between a risk factor and morbidity and mortality has been established. In this case, when policies have been adopted, intervention is in progress and the surveillance of both risk factor and disease continues to provide warning of any change that could adversely affect health. This also applies to the individual level, when early treatment is possible, and may apply in the case of public education to reduce saturated fat intake to prevent cardiovascular diseases.

Second, when a causal link (for example, between diet and some cancers) is not well enough established to have an effect on policy, studies are necessary to make it clear. If possible, the studies should be population-based and have survey or experimental designs. Here, surveillance is used primarily for monitoring disease, not for intervention. It can describe the status of the disease in the population,
however, or warn of any deterioration in health. Some insight into causality may also be provided.

The third possibility is a combination of the first two. In such cases, there is enough scientific evidence to suggest causality, but no policy has been adopted, usually because the link between the risk factor and the disease is not very clear. Although intervention is agreed to be likely to have some impact, the extent to which this will prevent disease or death is not known. As with the second situation, monitoring of both risk factor and disease must continue, to establish causality more clearly and thus to contribute to developing effective health intervention policy. In this case, data collection often has elements of both research (to establish causality) and advocacy (to promote policy decisions that scientists may consider necessary).

The different objectives of monitoring trends in disease and research into causality profoundly affect the methods chosen for data collection and analysis. The priority given to each depends on the situation's location on the scale of established policy.

Most of the noncommunicable diseases considered in this chapter are in the third situation; evidence suggests a link between a dietary risk factor and a disease. The evidence is not conclusive, however, possibly because the causal path is complicated and involves many other factors. In some cases, recommendations have been made to change dietary intake to prevent illness and death (1). It should be borne in mind that dietary information very often has to be obtained at an aggregate level. This means that health outcome data should be at the same level of analysis. Special studies on individuals, however, may be crucial for research. Their designs are likely to be determined by the difficulty of getting data on diet rather than health.

**What Is Health?**

The broad definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" in the 1948 WHO Constitution (2) marked a significant change in attitude. Major advances in health since that time have necessitated the adoption of a more focused definition. No definitive agreement has been reached, but the recent emphasis on health promotion or positive health, although a broad concept, has more clearly defined several components of health in which good nutrition plays a major role (3).

Good dietary habits have been recognized as a major factor in the prevention of ill health. About half of the deaths in people under the age of 65 years are estimated to result from diseases in which diet
plays a role (1). These deaths are considered premature and therefore preventable through adequate food and health policies. When the focus is widened to include disease and disability, however, the proportion of health problems preventable through dietary means increases dramatically. The emphasis here is on health as it relates to diet, and the prevention of ill health through dietary means requires consideration of the link between the two.

What to Measure

In addition to the problems in defining adequate health, the measurement of health status can be extremely difficult. The broad definition of positive health suggests a continuum from a state of normalcy to death. More and more emphasis is being placed on the prevention of disease and disability as the duration and number of chronic non-communicable diseases increase. Although research into measures of disability is continuing (3–5), it is still in the development stage and thus is not discussed at length here. Such research plays an increasingly important role in current emphasis on positive health, however; as diet plays a role in diseases associated with many disabling conditions, it undoubtedly affects these conditions.

In this chapter, only statistics on death and disease will be used in the health assessment of a population. Health can be seen as a continuum from good health (no clinical signs of ill health) through loss of function to disease and possibly death.

Along this continuum, many risk factors have an influence, and may lead to death. An intermediate condition could be considered an unhealthy state, but is unlikely to present significant symptoms. It may result from a combination of risk factors that would greatly increase the risk of disease or death by interaction. Hypertension is a good example, as it is likely to be caused by several factors but may not seriously interfere with day-to-day living. Some measurable loss of function would be the first clinically observable sign of decline in health, possibly leading to disease and death. As in most such complex systems, it is difficult to establish a direct relationship between these factors. Also, risk factors could influence this chain at any level. Numerous factors can be involved. Often, several dietary components interact to predispose an individual to a disabled or diseased state that precedes premature death. For example, poor dietary habits could be seen as a risk factor for obesity, which could be described as an intermediate condition leading to a loss of function and eventually a state of morbidity. Although the implications of this continuum may seem confusing for health and nutrition policy-makers,
intervention may be useful at various stages to prevent disability, disease and death.

**Mortality and morbidity statistics**
Indicators must be chosen to determine death and disease status. Cause-specific mortality rates are useful, except when several causes overlap, because they are available for almost all European countries and are standardized, accurate and processed periodically. This allows international comparisons and the monitoring of change.

A limitation of mortality statistics is that they do not reflect the population affected when a condition is not lethal. For example, there are more than twice as many episodes of myocardial infarction as deaths from the condition (1). Other such diseases or intermediate conditions include hypertension (as a risk factor for cardiovascular diseases), obesity and diabetes. Morbidity statistics give a more accurate picture of these conditions; the prevalence of the disease (the proportion of a defined group having a condition at a given point in time) or, more commonly, the incidence (the proportion of a group developing a condition within a stated period) is used.

The greatest limitation of morbidity statistics is their poor availability. At the population level, prevalence or incidence may only be available through central registries, and these are kept for only a few diseases, such as cancer (by the International Agency for Research on Cancer — IARC) and cardiovascular diseases (the WHO monitoring trends and determinants in cardiovascular diseases (MONICA) project). Hospital records are another source. Despite their limited use for population studies, because of questionable representativeness, such records have been shown to be reliable indicators of the prevalence and incidence of disease under certain conditions (6–9). They are more and more frequently used because, like mortality rates, they provide a readily and regularly available source of information on disease.

Difficulty in recognizing symptoms may be one reason for the rather slow progress in the measurement of disease status, particularly in the case of noncommunicable diseases, whose symptoms often overlap. In these instances, the presence of a risk factor may suggest a condition that could be an early warning of a potential increase in the disease or of death. Perhaps more research on the relationships between risk factors and disease will allow a more accurate assessment of the health status of a population.

**Other indicators**
Anthropometry and biochemical indicators can be used to assess nutritional status as a measure of health. Height, weight and skinfold
thickness measurements are examples of anthropometry; levels of iodine and haemoglobin in the blood can indicate micronutrient status. In most European countries, data on weight are collected routinely on pregnant women and used to monitor the health status of the woman and fetus. In addition, a combination of other biochemical indicators collected in maternal and child health clinics is used extremely successfully at the individual level in the prevention of mortality and the general improvement of health in women and their children. At the population level, anthropometry is used primarily in the European Region to measure obesity; it is used to detect levels of malnutrition in other regions. Maternal and child health clinics, which are relatively numerous in Europe, may increasingly be a source of anthropometric data.

Usefulness for Nutrition and Health Policy

Very simply, the responsibility of nutrition and health policy-makers is to develop food policies aimed at preventing death, disease and disability, thereby improving the general wellbeing of the population. Several policy issues should be borne in mind when health information is used, to obtain a better focus on what is needed, how it will be used, and the relative importance of each measurable aspect of health. These will only be mentioned here; more detailed discussions can be found elsewhere (1,10).

The development of policy on health and nutrition depends on the surveillance of the health status of a population; this in turn relies on accurate information. In preventing death and disease, policy-makers must have a reasonable assurance of a causal link between a risk factor and a disease. This does not, however, preclude the use of health surveillance information for further insight into causality, by strengthening existing knowledge or perhaps even collecting population statistics on factors suspected of causing health problems.

Indicators of Noncommunicable Disease Status in a Population

Cardiovascular diseases
Cardiovascular diseases, particularly coronary heart disease, account for about 21% (23% in men, 20% in women) of all premature deaths of men and women in the European Region (1). Mortality and morbidity statistics on coronary heart disease have been studied for
some time and clearly show sex and age differences, as well as regional variations in some countries.\textsuperscript{a}

The substantial amount of information available on this disease provides a solid basis for intervention from policy-makers. The correlations between many of the factors in the disease are well established (1), although all influential factors, particularly those that may protect against harmful effects, are not included. If the role of a risk factor is measurable and reasonably accurately described, it should be included in a country health profile.

\textit{Mortality statistics}

The number of premature deaths due to coronary heart disease is compiled routinely in most countries through vital registration. The global use of the International Classification of Diseases (ICD) ensures standardized cause-of-death statistics for comparisons between regions and cultures (11). The availability of statistics on mortality in specific population subgroups, however, varies between countries. Most include age and sex subgroups, some (such as France) have occupational subgroups and some (such as Finland) have income or region subgroups (12).

National-level mortality statistics can describe the population as a whole, but only the differences between major subgroups are useful for national health planning. The use of mortality data to monitor trends in coronary heart disease within these subgroups continues to be vital in assessing a population’s disease status, by targeting high-risk groups and following changes over time for any improvement or deterioration. Targeting high-risk groups allows policy to be better focused and thus more effective.

Mortality from coronary heart disease varies between regions in Finland, for example (1). National averages alone would allow comparisons of mortality from coronary heart disease in Finland with that in other European countries, but only data on regional differences will identify more specific problems. Data on these differences help to point out areas on which policy should focus. Concentrating nutrition policy attention on the areas with the highest mortality might be more effective in preventing coronary heart disease, if choices have to be made.

Monitoring requires an examination of mortality trends over time; Fig. 1, for example, shows cardiovascular mortality trends in both sexes in Finland. Effective monitoring would have shown the

\textsuperscript{a} Brzezinski, Z.J. Mortality in the European Region. Copenhagen, WHO Regional Office for Europe, 1985 (unpublished document ICP/EXM 001/g07).
A mortality increase in men around 1961 and efforts could have been made to identify the causes. Although all the reasons for this sustained increase were not found, some minor influences were recognized, including a serious influenza epidemic in December of 1971. The possibility that changes in reporting or diagnosis cause such trends should always be investigated.

The limitations of vital statistics are well known (3,6) and are not discussed here. Most affect the accurate measurement of prevalence or incidence rates but not the monitoring of changes, provided that the problems do not change.

Morbidity statistics
Morbidity statistics on coronary heart disease are not widely collected at the national level, although they are becoming available for certain regions through surveys or projects of smaller scale. The WHO MONICA project provides a good example of the collection of these statistics in regions carefully chosen so as to be reasonably representative of the total population (13). Data are collected on mortality and morbidity from cardiovascular diseases (14).
Myocardial infarction registers are a source of incidence data that could give a better reflection of national trends in cardiovascular diseases. Although this method was attempted in the 1970s (15) and is used successfully in some communities (6), it is not widely practised because of diagnostic problems and the sheer magnitude of the information collected.

The use of sentinel sites for monitoring the incidence of coronary heart disease, as in the MONICA project, seems the most cost-effective way of obtaining representative data over time. A sentinel site is a centre that ideally has been shown accurately to reflect national trends, or at least not to reflect only the healthier population subgroups. Several sentinel site methodologies are currently in use in various countries (6,16). The sites can be entire cities, communities or hospitals (particularly when all cases of a particular disease are referred to a single hospital). The number of cases and sites required depends in part on the magnitude of the event, in this case myocardial infarction, and on how representative of the population the data should be. The rarer the event, the more cases are needed to avoid an inaccurate calculation of incidence; the more sites that are included from different areas of a country, the more representative the data are likely to be, especially if incidence varies between areas.

Hospital inpatient records are another possible source of coronary heart disease incidence rates. Several criteria must first be met, however, before these data can accurately reflect national trends. One major criterion is the likelihood of hospitalization, which is related to the severity of the illness. As a victim of a myocardial infarction has a very high probability of being admitted to hospital, inpatient records could be a reliable source. Other criteria are described in detail by Eylenbosch & Noah (6) and more generally by Roger (8). Scotland has a successful system for the use of hospital data for disease surveillance, as does the Mayo Clinic in the United States.

Risk factors
Dietary risk factors are the major concern of this publication; some of the other risk factors or conditions are discussed in Healthy nutrition (1).

In certain circumstances, measuring the risk factor status of a population may provide information on the disease. At best, the prevalence of a risk factor can be an accurate and timely warning of the incidence rate of disease if the risk factor is strongly associated with the disease state. For example, as levels of serum cholesterol increase, so do coronary heart disease incidence and mortality rates. The measurement of serum cholesterol can therefore be used to monitor the risk of this disease in a population.
Cancer
Doll & Peto (17) suggested that perhaps 35% of all types of cancer may be linked to dietary factors. Morbidity statistics for cancer are more informative than mortality rates, because the duration and outcome of the illness vary enormously between types. This is due to both the nature of the disease and the treatment available. While lung cancer has a fairly poor prognosis, for example, the survival period for people with breast or colon cancer is quite long.

Mortality statistics
Mortality statistics can be obtained from vital registration. IARC provides these data at the national level (18). All deaths are classified according to ICD coding, so that they are consistent internally and between cultures. Another source of mortality rates is cancer registries, which are either population-based or hospital-based. Population-level statistics are less comprehensive than hospital statistics because they require a greater volume of information, are not concerned with treatment or management, and use broader categories to identify the cancer. Nevertheless, they usually give sufficient information on deaths by site, age, sex and geographical region for the monitoring of cancer mortality.

Mortality statistics approximate incidence when the cancer has a low survival rate. For types of cancer with a good prognosis, incidence will be much higher than mortality rates, and as such may be a more accurate indicator. Even in these instances, however, mortality statistics can give some indication of the extent of cancer in a population, as long as the survival rate does not change very much or very rapidly, for example, as a result of improved treatment.

Changes in the coding of the disease or cause of death are a source of bias in the reporting of cancer mortality. Such changes affect mortality rate presentation, particularly if the cancer is rare or if the patients die from a secondary cause. Other problems with mortality statistics are discussed elsewhere (6).

Morbidity statistics
Morbidity statistics are more reliable for cancer than for most other diseases because the system of registration of cases is established in many countries in the European Region. Some cancer registries have been in existence since the 1930s (19). Whether population- or hospital-based, most registries follow techniques described by MacLennan et al. (20).

The major aim of the registries is to provide information on the incidence of cancer. Problems with the accuracy and validity of these morbidity statistics depend more on the completeness of registration
than on problems with classification or methods of coding. Very often, the quality of the data can be checked through verification by histological records, death certificates or mortality/incidence ratios (18). For example, the mortality/incidence ratio will be low if the cancer has a low degree of fatality. If the number of deaths is higher than expected, that is, if the mortality/incidence ratio is too high, the measured incidence may be too low. This may suggest that the completeness of reporting needs improvement.

Again, spurious changes in incidence may arise from improved diagnostic criteria. In this case, incidence increases, although mortality should remain constant. This bias should be readily identifiable, as the cause is known and the effect predictable. The same increase in incidence, with no change in mortality, could occur when a screening programme is instituted (such as that in the Mayo Clinic for lung cancer) that identifies cases that would otherwise go undetected (6). This is the more likely to happen the less virulent the disease; that is, there is thus a lower likelihood of it coming to medical attention under normal circumstances.

For public health planners, these sources of bias may present problems in monitoring incidence. Mortality statistics may be more useful, even though they are not a reliable indicator of the extent of disease when the degree of fatality is low. In addition, incidence should be monitored with clear indications of when possibly influential changes occurred.

Risk factors
The measurement of risk factors gives an accurate assessment of cancer prevalence in a population only when there is a high degree of association between the risk factor and the cancer. Although the link between cancer and exposure to high levels of ionizing radiation is well established, links with dietary factors are not nearly as strong. This does not mean that diet plays an insignificant role, but that the link between the dietary component and the development of the disease is not clear.

The protective effects of some dietary factors contribute to the difficulty in firmly establishing the link between cancer and diet. For example, a high-fibre diet has been associated with low rates of colon and stomach cancer, vitamin C may protect against stomach cancer, and vitamin A against cancer of the lung and oesophagus (21). Policy recommendations might therefore include increasing intakes of these nutrients, as well as decreasing intakes of those linked with cancer. If this strategy were effective, however, the respective effects of the factors on the disease could not be distinguished.
When the link between a risk factor and disease is uncertain, nutrition policy-makers may not wish to recommend that people try to change their behaviour. Table 1, however, clearly shows decreases in lung cancer death certification rates in men in England & Wales after the large decreases in tar delivery per cigarette in about 1960 (22). When the link between a risk factor and disease is as well established as smoking and lung cancer, adequate health policy could have a major impact on reducing disease and death.

Diabetes
Of the two types of diabetes mellitus, the non-insulin-dependent variety accounts for 80% of all cases of the disease in Europe. The two types appear to have different causes (1). Viral and genetic factors have been implicated in insulin-dependent diabetes, but the environment is presumed to play a more important role in non-insulin-dependent diabetes. For this reason, preventive action through a nutrition policy has a better chance of success with the latter type. Nevertheless, insulin-dependent diabetes deserves serious attention from nutrition policy-makers owing to its poor prognosis.

The intermediate conditions that predispose a person to diabetes are better established than proposed dietary risk factors. Although the disease cannot be cured, it can be treated or controlled to prevent disability or loss of function. People with insulin-dependent diabetes usually require insulin injections; non-insulin-dependent diabetes is often controlled through diet. Death as a result of non-insulin-dependent diabetes usually comes from problems of the circulatory system, the most common of which are kidney failure and coronary heart disease. Mortality statistics are thus not very meaningful.

Morbidity statistics
Because insulin-dependent diabetes requires medical attention, information on prevalence and incidence can be readily obtained from hospital records or registries. Other sources of data include school records and screening programmes (1).

Prevalence data are particularly useful because diabetes cannot be cured and diagnosis by glucose tolerance test is relatively easy to carry out on a population basis. A major problem exists with the criteria for diagnosis, however, as different measures with varying reliability are used (1). Although this will not interfere with monitoring prevalence if the criteria do not change, the rates may not be accurate and thus comparisons between sources using different criteria may be meaningless.
Table 1. Recent trends in lung cancer death certification rates per million men aged 30–59 years in England & Wales, 1953–1983

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Death certification ratea</th>
<th>Percentage change from 1958 to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>30–34</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>35–39</td>
<td>100</td>
<td>94</td>
</tr>
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<td>40–44</td>
<td>250</td>
<td>253</td>
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<tr>
<td>45–49</td>
<td>584</td>
<td>594</td>
</tr>
<tr>
<td>50–54</td>
<td>1232</td>
<td>1254</td>
</tr>
<tr>
<td>55–59</td>
<td>2018</td>
<td>2326</td>
</tr>
</tbody>
</table>


Source: Zaridze & Peto, ed. (22).

Risk factors
There is no conclusive evidence that dietary intake is related to non-insulin-dependent diabetes. Obesity is a known risk factor, however, causing an insulin resistance that may be related to a high intake of fat or energy. The prevalence of obesity shows a strong relationship with diabetes. Because obesity may be only marginally easier to measure than diabetes, however, it may not be a sensible alternative indicator.

Conclusions
There is still a long way to go towards preventing disease and death through dietary means, but successful intervention is possible. Most diseases still require continued monitoring of disease and risk factor status before policy can be formulated. For coronary heart disease, monitoring national trends in causal factors and outcomes is the priority. For cancer, monitoring of both risk factors and the disease is still necessary, and further research is needed on non-insulin-dependent diabetes. Combined with more rigorous epidemiological studies, such monitoring can help to establish causality. This should lead to decisions to intervene early enough in the health continuum not only to prevent death and disease but also to reduce disability and promote health. Annex 2 gives an example of a food and nutrition
surveillance system proposed in Norway, which contains some of the health variables discussed in this chapter.

References


Food balance sheets

A. Kelly, W. Becker & E. Helsing

A food balance sheet is an account at the national level of the annual production of food, changes in stocks, imports and exports, and agricultural and industrial uses within a country (Fig. 1). When these have been taken into account, what remains represents the food that can be assumed to have been available for human consumption in the country. Usually per caput supply is expressed in kilograms per year or grams per day. To see whether the figures that have been arrived at make sense, per caput energy and macronutrient availability are normally also calculated. These figures may then be compared with the results of other sources of information, such as household food consumption data or special dietary surveys.

Three considerations

Sources of food balance sheets
Since 1949, FAO has compiled and published food balance sheet data for most countries in the world (1). In some cases, the data collected go back to 1934. OECD has collected and published similar but not identical data for its member countries since 1954 (2). In 1971, FAO included its food balance sheet data in the statistical data system known as the Interlinked Computer Storage and Processing System of Food and Agricultural Commodity Data (ICS). ICS contains information on about 200 countries, 300 primary crop, livestock and fishery commodities and 380 processed products derived therefrom. In general, the information extends to the first stage of processing for

\[^{a}\text{The authors thank Dr G. Malcotti, FAO Statistics Division, for critically reading the manuscript, and providing advice based on his many years of experience with food balance sheet data.}\]
crops and fishery products and the second stage of processing for livestock products. The ICS series covers the period since 1961.

In addition, many countries compile national food balance sheets, although these are not always published. While most countries compile and publish some commodity balances, they do not necessarily generate summary balance sheets.

**Availability of data**

FAO and OECD usually publish summaries of data every three to five years, with a time lag of three to four years between the latest figures and the year of publication. Each year FAO publishes data on the per caput availability of energy and some nutrients up to the previous year (3). ICS can supply more up-to-date figures through direct
linkage with a computer network or on computer tape or paper printouts. National food balance sheet data, where these are compiled, also tend to be more up to date and are normally available annually, again with a time lag of up to three years.

Users of data should remember that data from different sources may differ significantly, owing to the assumptions and methodologies underlying their compilation and presentation.

**Updating of data**

In essence, food balance sheet data are derived from statistics on national and international agricultural or industrial production and trade, which may be published with delays of several years. For national sources, the most recent data are commonly provisional, and may be corrected and adjusted over several years. Estimates for any commodity for a given year are often refined over the following year or two; hence, both FAO and OECD continuously update their figures. This is why successive publications overlap and why recorded values for individual foodstuffs may change from one publication to the next. When there are gaps in the series of figures, FAO uses estimates based on expert opinion obtained in the countries. ICS maintains internal consistency when corrections are entered.

These facts imply that the latest data are usually by no means final, and updated figures should always be sought. When such data are used, their source or the date they were obtained should always be quoted.

**FAO Food Balance Sheets**

As the data source most commonly used both for international comparison and when national data are missing, the FAO food balance sheets deserve special attention. Annex 3 provides detailed suggestions for users of ICS.

FAO has quite clear definitions of the terms used in handling the data (1). Six are particularly interesting for nutrition policy-making:

- domestic supply
- food
- per caput supply
- problems in handling data
- the presentation of data
- the standardization of data.
Domestic supply
As shown in Fig. 1, production plus imports minus exports plus changes in stocks (decreases or increases) equals the supply available for domestic use. Amounts lost of feed, seed, manufacture for non-food use and waste are then subtracted, to arrive at the amount of food.

Food
Food is the amount of the commodity in question (and of any other commodity derived therefrom not further pursued in the food balance sheet) that is available for human consumption during the reference period. It is important to note that this does not indicate the food actually consumed, but is an average of the quantity of food potentially available for human consumption.

Strictly speaking, food balance sheets demonstrate how much food disappears from the accounts every year. Thus they are sometimes referred to as food disappearance data, a term that is not readily understood by the general public.

Per caput supply
According to FAO, per caput supply means the total supply available for human consumption divided by total population. For the conversion of foods into nutrients in Europe, regional food tables are used (4,5). These tables take account of, for example, the extraction rate of flours, inedible parts of the commodity and kitchen waste.

In general, the mid-year estimates published by the United Nations Population Division are used to calculate population. In some cases, adjustments are made to include migrants and refugees who partake of the available food supply, or to consider tourists and seasonal workers. In the latter case, however, the corrective action does not concern the population figure itself but the figures for food supply: a certain amount of the selected commodities that tourists or workers are likely to consume is subtracted from the domestic supply.

Problems in handling data
The reliability of the information is a general problem in handling data. As far as possible, the FAO country clerks responsible for compilation use national sources of information, but for consistency they check external sources as well. Still, broad assumptions have to be made time and again. In general, FAO does not want information on commodities after the first level of processing; data on primary products are presented. Obviously this can cause problems in dealing with exports and imports, as the composite nature and varying composition of these foods may make it impossible to convert them to primary commodity equivalents.
In addition, estimates of amounts of food lost to feed, seed and waste are by their very nature prone to error, and may change over time for economic or structural reasons.

Presentation of data
The 380 foods identified in the ICS database are grouped in 16 categories. To avoid too bulky a presentation, further grouping has resulted in 300 entries usually being presented. Sometimes this grouping may “split” foods; for example, whole milk is entered under milk, but butterfat is found under fats and oils. At times, too, new commodities may be slow in finding their way into the food balance sheets.

The conversion of food to nutrient data is done on the understanding that the results are rough averages. For clarity, however, the figures are presented without rounding off. Similarly, data on micronutrients are indicators of the main sources of these nutrients, and of the proportional contribution of each food or food group to the total diet. There are several problems in this conversion; for example, micronutrient fortification of foods is not recorded in these figures (see Chapter 8).

Standardization of data
The FAO food balance sheets give standardized information on major food commodities, energy and a selection of nutrients. Standardization makes it possible to present data on many countries and to show trends in the supply of food and differences in levels between countries.

Again, the data do not lend themselves to the determination of actual consumption. They should therefore not be measured against, for example, recommended daily intakes of nutrients (see Chapter 10).

Some General Caveats

As indicated, food balance sheets are assembled from a variety of official statistics and other sources. Their quality varies considerably between countries and commodities. There may be inaccuracies and errors at each stage in the construction of a balance sheet. Adjustments based on informed judgement are normally made. The user of these data must therefore bear in mind their limitations, some of which are spelled out here.

First, there may be significant trade across national borders, often influenced by differential government or European Community subsidies. Imports via tourism may also be of some importance. FAO
does not record these figures, but data may sometimes be available at the national level.

Second, products that do not enter the commercial market system (because prices are depressed, for example) can significantly affect figures on the stocks of certain foods. The commodities affected include vegetables, fruit and wine, all of which are sensitive to such interrelated factors as harvest size, market price and crop quality. In such cases, sizeable quantities may be bartered or retained for home consumption.

A separate but similar type of underrecording occurs as a result of the growing or catching of foodstuffs specifically for home consumption. Data on such foodstuffs are available only in a few countries. This source of production is largely hidden, although attempts to estimate it are made during, for example, household budget surveys. It is clearly important and may contribute substantially to national food availability, depending on the commodity in question.

Third, production may need to be inferred from trade statistics. Certain cereals or root crops, for example, may have to be calculated from the reported harvested area and estimated yield per unit area.

Fourth, the accuracy of recording differs substantially between foodstuffs, as certain items (such as sugar) are produced centrally, while others (such as vegetables) are not.

Fifth, recording accuracy may improve or deteriorate with time for different products, and is likely to differ between countries. The methods of collecting production data may change at any time in any country. This may lead to inconsistencies in the reporting. One response then is to revise earlier figures; some countries, on the other hand, simply report a break in the series. As mentioned, FAO periodically undertakes such revisions from the latest year to the start of the ICS series in 1961.

Sixth, waste may also be a source of error, since it varies considerably between countries and commodities and over time. Waste occurs at several levels of the food chain. Sometimes a standardized figure of 10%, for example, is given, although it is hardly verifiable. Similarly, the term offal may constitute a source of error, as the definition of edible offal (such as intestines, blood, whey and parts of vegetables) varies between food cultures. FAO, for example, does not include blood in its estimates. Pet food is another source of possible error; it may be counted partly as offal and partly as waste. This kind of utilization has been estimated to comprise an average of about 5% of the total energy available (6). For certain items, product weight may be recorded; for example, a whole carcass may include inedible portions.
Last, the conversion of available foodstuffs into nutrient equivalents by the application of factors derived from different sources must be treated with caution, if not scepticism. This topic is further discussed in Chapters 7 and 8.

Comments on Some Commodities

Potatoes
Estimating the supply of potatoes is complicated by many of the problems discussed. Potatoes are an example of a commodity for which there are a large number of small producers, a substantial noncommercial element, and a difficult-to-quantify animal feed allocation, which varies with the quality and volume of the crop. Large quantities are often imported for direct consumption or further processing. Waste owing to spoilage and processing losses is particularly difficult to estimate. In some national food balance sheets, data from household budget surveys are used to help estimate the supply of fresh potatoes.

Vegetables
Factors such as noncommercial production and losses to animal feed, spoilage and waste also pose severe difficulties for arriving at a reliable figure for the net availability of vegetables. Corrections may cause pronounced variation in recorded availability from one year to the next. Many countries experience this problem with vegetables.

Dairy products
Although there is a large number of small producers of milk, the statistics on volume are reliable because the vast bulk of milk in most countries is treated by large farmers’ cooperatives. Small quantities of unprocessed milk for home consumption, however, do not reach the market. Butter and cheese production are similarly well controlled in most European countries, but the contribution of new butter substitute products is less clear. The yellow fat component of these substitutes is often ascertained and used as a basis for determining the butter product equivalent.

Meat
Statistics on meat may be given in the form of carcass weight, with or without bone, depending on their source. They, too, are liable to considerable annual variation owing to the scale and timing of exports. Cross-border smuggling can be significant, depending on current differential premiums associated with, for example, the Common Agricultural Policy of the European Community.
Noncommercial production can add to uncertainty, particularly in countries without a large meat-processing industry.

Other foods
Some food items (such as the offal of cattle, sheep, pigs and fish) may be omitted from the accounts because of particular difficulties in tracing production and distribution. In addition, alcoholic drinks constitute a special problem. Reliable data are normally available on beer and spirits through customs and excise records. In the major wine-producing countries, however, estimates may fail to capture a significant volume not reaching the market-place.

Utility of Food Balance Sheets
Briefly, food balance sheets describe the current and evolving structure of a national diet in terms of the major food commodities and selected macronutrients that enter and disappear from the market. They are invaluable in determining whether a nation as a whole is moving towards meeting national dietary recommendations. With these data as a starting point, the influence of economic and demographic factors over time can be investigated. Short-term forecasts can be produced to anticipate changes that may reflect developments or interventions in the market.

Possible relationships between trends in food and nutrient availability at the level of food balance sheets and national trends in chronic disease mortality (also at a highly aggregated level) have been used to generate hypotheses about the role of diet in disease development. International comparisons (see Chapter 9), using both cross-sectional and time series data, can help to indicate the position or progress of one country in relation to others (7). Such comparisons must, of course, be interpreted with due caution.

National nutrition policy planning
The accumulated expertise of the agency responsible for compiling the figures (whether a national government, FAO or OECD) tends to minimize or offset some of the limitations discussed in this chapter. Repeating the exercise on an annual basis for several decades results in a high degree of consistency and sound judgment and a corresponding measure of reliability. Consultation with the responsible agency before, during and after the use of its data is strongly recommended. This often leads to access to a more detailed breakdown and to a better understanding of the data.

Every European country could compile food balance sheets, which may be the only regular source of information about its dietary
pattern. Unlike household surveys, food balance sheets normally cover all foodstuffs and may make data available on an annual basis, usually over a long period, with an acceptable time lag.

In addition, the data are available free of charge to a nutrition information system, apart from the costs of acquiring and analysing them. These costs are nominal in the case of FAO data, which are usually made available gratis. The collation and analysis of national-level food balance sheets, however, may be more time consuming and costly.

Last, with the exception of mortality statistics (and data from international collaborative projects such as the WHO MONICA project), food balance sheets represent the only source of standardized data that permit consistent longitudinal international comparisons.

Conclusions

Food balance sheets provide no information on consumption patterns: the data relate only to the supply or availability of foods at the national level. The value for a certain food in a particular year may not be a very accurate reflection of its supply; only comparisons based on long-term trends are valid. The nutrient values provided must be treated with even more caution than the corresponding food supply figures, because of the limitations imposed by the use of somewhat arbitrary conversion factors. The timeliness of the data is reasonable, and projections to the current year and beyond are feasible. Finally, relevance is assured in so far as these data, used in conjunction with additional information from other sources, meet the essential needs of strategic planning for nutrition policy.

References


As explained in Chapter 2, the household budget survey may have an important place in a nutritional information system. At the moment, however, only about half of all household budget surveys in Europe collect data appropriate for this purpose. This chapter discusses various types of household budget survey and the changes necessary to make them useful for nutrition policy-making. Annex 4 comprises a review of surveys in 16 Member States of the European Region, and the United States of America.

Definitions

Basically, there are two types of survey. First, the household budget survey in an economic sense records the expenses for food commodities purchased or obtained by other means by a household during the survey period (I). The economic purpose is to derive the weights required to update the national consumer price index and economic policy planning. The second more specialized form, often called a household food consumption survey, also records the amounts of the food and drinks brought into the household. Some surveys may even go a step further and measure the changes in food stocks, in addition to acquisitions, to provide a more accurate measurement of actual consumption in a household.

Purposes, Possibilities and Limitations

As a consumer price index is important in making wage and price policy, for example, household budget surveys must be carried out in most countries. In general, the people surveyed are representative of
the population as a whole. The data from more or less regular surveys with some degree of consistency in their methodology may form a valuable time series, from which trends in food consumption can be derived. This makes the survey useful for a nutrition information system.

Trends in the per caput availability of food can also be derived from food balance sheet data, although these give no information on the distribution of food in different segments of the population. The results of household budget surveys, however, can supply information on food and nutrient patterns in subgroups of households. These subgroups may be classified by social, economic, geographic and demographic factors, depending on the additional data that are collected about the households.

The correlation of the acquisition of different food groups with these data is informative, particularly for tackling policy issues such as food taxes, subsidies, fortification and supplementation. For the latter, however, the information must be handled carefully. All surveys do not collect data on food acquisition outside the household, and none gives information about consumption by the members of the household.

Determining the proportion of total household expenditure on goods and services that is devoted to food may also help to identify household groups potentially at risk. These at-risk groups may be classified by demographic factors, unusual expenditure patterns and a food or nutrient pattern judged to be inadequate. In this respect, it is often better to use figures for the quality of the diet rather than for intake.

In addition, data from household budget surveys are sometimes used to validate the results of other studies. Owing to the limitations of the surveys, however, this can be done only in a very limited way.

Techniques Used

Again, almost all European countries regularly amass data on households' daily expenditure on consumer goods and services, including food. At present, the dietary part of these data are collected in a variety of ways and are therefore not directly comparable between countries. Differences are found in sampling procedures, the period covered and the frequency and technique of data collection (2).

The data collected on the quantity of and expenditure on food may be recorded by either the diary or the recall method. Often a diary is used for the regular recording of expenditure and a separate questionnaire asks specific questions on demographic data and irregular
(yearly) important expenditure on insurance and holidays, for example. The diary and the questionnaire might be completed either by an interviewer or by a member of the household, usually the housekeeper. The length of the survey of each household may differ.

As previously described, not all household budget surveys request participants to record the amount of food purchased; many ask only for expenditure (2). To convert these data into amounts, the researcher must know the actual prices of food at the time of acquisition. Sometimes the data are used to estimate amounts of food consumed (3).

In the more specialized forms of survey, the amounts of food purchased may be recorded for all food items or those in a few food groups. Some of these surveys measure the changes in food stocks. The annual national food survey in Great Britain, for example, assumes that, by averaging purchases and the consumption of food obtained free over a sufficiently large group of households, increases in the stock in one household will balance reductions in another. This is a reasonable simplification, provided that net stock changes are small in comparison with average acquisition over the period. The further conversion of data from households to their members may also be done in various ways.

Aspects of Survey Design and the Collection of Data

Objectives
Because there are different types of household budget survey, the objectives of the data collection, both the broad overall goals and more specific details, must be stated before the survey is begun. This should be done in collaboration with experts from different disciplines such as statistics, nutrition and economics. In this phase, actual and potential users of the data to be collected ought to be invited to describe the kind of information they need, in users’ conferences, for instance. Since comparisons between countries may be important, the international harmonization of data, by using a common coding system for food classification, for example, would be desirable (4,5).

Duration and frequency of data collection
In general, data sampling covers a whole year; sometimes special times such as holidays are excluded. Each household records its expenditure during a part of the sampling period. The length of this recording time is related to the sample size; the more respondents, the shorter the recording period. A well designed survey provides data
representative of the whole year. In practice, the recording period varies from 5 to 30 days per household, evenly spaced over the year.

Bulk buying, purchasing foods for the household, say, once a month, can be a problem if the recording period is only one week. Special arrangements have to be made for these households.

The ultimate use of the data should determine how often they must be collected. If a basis for food strategies in a nutrition policy is needed, one baseline survey describing current dietary patterns is sufficient. Data for use in evaluations of the implementation of a nutrition policy or in monitoring the process of food and nutrition policy-making, however, must be collected at regular intervals. The interval between collections should depend on the expected changes in food habits. In general, it should not be longer than three to five years. Sample size in relation to the maximum research capacity should also be considered when deciding on the frequency of data collection. If the capacity is small, the frequency of collection should be increased. In practice, the costs of the survey must be weighed against the usefulness of its results.

Sample selection
In the first place, the make-up of the sampling unit should be clear. This means that the word household has to be defined. Some countries, for instance, do not include single-person households. Sometimes, attending a certain number of household meals per week is used as a criterion for membership.

The exclusion of subgroups, such as foreign workers and people living in institutions, from the sample should be described. The sample should be representative. This should be checked, at least for the following five characteristics: composition, geographical region, degree of urbanization, and socioeconomic and employment status.

In general, the sample size is limited by the high costs of surveying it. This reduces the chance of identifying small subgroups at risk. If other sources of data seem to indicate that a certain group is at risk, this group may be oversampled in the survey to obtain sufficient data for statistical analysis. If information from general household budget surveys is to be used for economic policy planning, however, oversampling certain groups for reasons of nutrition would not be acceptable, particularly because keeping the overall sample size constant for reasons of cost would require the undersampling of other groups. As an alternative to oversampling, results for a group at risk can be aggregated over a sufficiently long period (a year rather than a quarter, for instance) to obtain sufficient households for analysis.

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Encouraging households to participate in the survey

To reduce non-response, all possible means should be used to motivate households to participate in the study. The important role that interviewers play should be taken into account in their selection. Training ought to supply interviewers with the arguments necessary to persuade respondent groups to participate. These might be the same types of argument used by marketing personnel.

Respondents can be warmed up for the survey by letters or announcements via radio, television and newspapers. If the reasons for reluctance to participate are circumstantial, it may help to plan the interviewer's visits at alternative times of the day. Flexibility in the time of entering into the survey may also help. If the reluctance has other causes, more publicity, better training of interviewers or remuneration may increase the motivation to participate. Remuneration, however, can be used only to a certain extent, or it will bias the sample. Regular feedback of the information collected in the study is also important in motivating respondents.

Demographic and other background data

Data on the background of the respondent should include at least:

- the type of household (its composition and the ages of household members);
- the education, income level and employment status of the members;
- geographic location (region); and
- attendance at meals (number of people, including guests).

The use of special and therapeutic diets, and food supplements may also be included.

Collecting data on food

Although, as described earlier, the researcher sometimes uses data on prices to estimate the amount of food bought, such estimates are very rough. Asking the housekeeper to record the amounts in addition to the prices of food gives more accurate results. Other important aspects to consider in collecting the data on food are:

- compatibility (in food codes, classification and nomenclature) with the food composition tables that will later be used to convert food to nutrients;
- the degree of detail necessary to convert food into nutrients; and
- chances of linking the data with other national or international data sets.
Validation and Presentation of the Data

At a minimum, household budget surveys should supply information on product and macronutrient availability, in addition to product expenditure data for the average household or the categories of household surveyed. Table 1 gives an example of the presentation of such information. Before the information is presented, however, several aspects of the validity of the data should be considered.

Representativeness of the sample
In general, rates of non-response to household budget surveys are high, ranging from 27% to 60%. Methods must therefore be found to describe the characteristics of non-respondents, at least their reasons for not participating, their socioeconomic status and the composition and location of the households.

The effect of non-response on results, in both the sample as a whole and various subgroups, should be analysed. In subgroups, the sample may have to be stratified according to willingness to respond to obtain a sufficient number of households.

Checking and validating the results
The results of the budget survey may be validated by comparing them with the results of other types of survey. In general, absolute amounts cannot be compared, but trends over the years in consumption and expenditure should move in the same direction. Sources that can be used for such comparisons are:

- sales statistics for certain products
- data from market surveys made in a time series
- food balance sheets
- individual longitudinal dietary surveys.

A valid comparison can be made only if food is measured in similar forms or at similar levels of processing. In comparing trends in the use of food groups, the contribution of the food group to a specific nutrient may be used. Eurofoods (a network of people who conduct dietary surveys) has developed a food coding system with 23 food groups (4,5). The widespread use of this code may help to harmonize household budget survey data in Europe.

Waste and food given to pets
The amount of food wasted or given to pets may differ between countries, regions and social classes and may change over time.
### Table 1. Percentage distribution of food costs, energy and energy-supplying nutrients in food entering private households in Norway, 1980–1982

<table>
<thead>
<tr>
<th>Food</th>
<th>Costs</th>
<th>Energy</th>
<th>Fat</th>
<th>Protein</th>
<th>Sugars</th>
<th>Total carbohydrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>7</td>
<td>24</td>
<td>3</td>
<td>25</td>
<td>—</td>
<td>42</td>
</tr>
<tr>
<td>Cakes</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Potatoes and potato products</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>—</td>
<td>9</td>
</tr>
<tr>
<td>Vegetables</td>
<td>5</td>
<td>1</td>
<td>—</td>
<td>2</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>Fruit</td>
<td>9</td>
<td>5</td>
<td>—</td>
<td>1</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Meat and offal</td>
<td>24</td>
<td>11</td>
<td>20</td>
<td>24</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Fish</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Eggs</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Milk</td>
<td>7</td>
<td>11</td>
<td>14</td>
<td>19</td>
<td>—</td>
<td>7</td>
</tr>
<tr>
<td>Cream, ice-cream, etc.</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cheese</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Butter</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Margarine</td>
<td>2</td>
<td>11</td>
<td>27</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Other fats and oils</td>
<td>—</td>
<td>1</td>
<td>4</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Refined sugar, syrup, etc.</td>
<td>2</td>
<td>8</td>
<td>—</td>
<td>62</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Soft drinks, beer, wine and spirits</td>
<td>11</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Coffee</td>
<td>4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Chocolate, sweets and other confectionery</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>—</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

*Note.* — = less than 1%.

*Source:* Johansson (6).

Separate studies are needed on this topic; if such studies exist, they should be used to estimate the effect on the net availability of food for the household.

**Allocation of household consumption to household members**

The conversion of consumption data from households to their members can be done in a number of ways, ranging from simply dividing the total by the number of people in the household, to assigning different factors to different age groups, as shown in Table 2, or even a differentiated weighting for different types of food, as shown in the following conversion exercise.
Table 2. Scaling used in household budget surveys to determine units of consumption

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of units&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants, under 2 years</td>
<td>0.2</td>
</tr>
<tr>
<td>Children:</td>
<td></td>
</tr>
<tr>
<td>2–3 years</td>
<td>0.3</td>
</tr>
<tr>
<td>4–5 years</td>
<td>0.4</td>
</tr>
<tr>
<td>6–7 years</td>
<td>0.5</td>
</tr>
<tr>
<td>8–9 years</td>
<td>0.6</td>
</tr>
<tr>
<td>10–11 years</td>
<td>0.7</td>
</tr>
<tr>
<td>12–13 years</td>
<td>0.8</td>
</tr>
<tr>
<td>Adults:</td>
<td></td>
</tr>
<tr>
<td>Males, 14–59 years</td>
<td>1.0</td>
</tr>
<tr>
<td>Females, 14–59 years</td>
<td>0.8</td>
</tr>
<tr>
<td>Both sexes, ≥ 60 years</td>
<td>0.8</td>
</tr>
</tbody>
</table>

<sup>a</sup> The number of units is based on the energy requirement of the group.


A conversion exercise<sup>a</sup>

Food consumption data are collected from households that differ in composition (in the age, sex and number of household members, for example). How is the consumption of the members of households to be determined? Moreover, how are comparisons of the material wellbeing of these people to be made? Apparently, Ernst Engel (8) was the first to realize the problem and propose a solution: measuring the size of a household in consumer units.

These units are determined from a sample other than the consumption sample, on the basis of the weight and height of people varying in age and sex. On this basis, Engel set a newborn baby as 1 consumer unit, which increased every year by 0.1, up to a maximum of 3.0 for a woman aged 20 years and 3.5 for a man aged 25 years. Additional years did not change these amounts. For comparisons of people’s material wellbeing, in either a cross-sectional or longitudinal sense, Engel measured the consumption per consumer unit in different households (8).

Prais & Houthakker (9) later extended the idea. First, they recognized that consumer units should be estimated using information on the consumption and the composition of the various

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<sup>a</sup> This section, pp. 56–57, was compiled by Professor G. Karg.
households in the sample. Second, they stressed that consumer units should be differentiated with respect to single items and total consumption.

These ideas can be explained by an example. It refers to two households (A and B) and three food items: bread, milk and wine (Table 3). Consumption is expressed in money units per unit of time. Physical units are introduced later.

The allocation of the household consumption to the members of household A is given. The consumption of the adult is set as 1 for each item and for total consumption. The consumer units of the child are thus 0.5 for bread, 2.5 for milk, 0 for wine and 0.46875 for total consumption. Consumer units can be determined in this way for single items, total consumption and different types of people. If this information is known, household consumption data (measured in money units) can easily and exhaustively be allocated to individual members. For instance, household A consists of 1.5 consumer units for bread. The amount of bread consumed then totals 20 units per consumer unit, and 20 and 10 units per adult and child, respectively.

If physical units are used to measure household consumption, the consumption data can easily be converted into nutrient intake with the help of information on the nutrient content of food items.

Although consumer units are not generally known, they can be estimated, using the information on the composition and the consumption of the various households of a sample. Moreover, restrictions may be used in these estimates. For instance, some specific consumer units may be known in advance, such as the consumer units of a child with respect to wine. Further, the consumer unit for the total consumption of a given person or group is always a weighted average of the units for single items. The weights are defined in Cramer (10).

Usefulness of consumer units
In general, consumer units are not determined for every conceivable product or food item and person, but for food groups and person groups. They are primarily intended to be used in evaluating the energy supply but have also been used to compare the food supply in different types of household.

Because consumer units can be used to determine the availability of food or nutrients per consumer unit in a given household and period of time, their use makes the data supplied by households of different size and composition more comparable. Consumer units can also be used to estimate the food and nutrient intake of different members of the households under investigation. Owing to the meaning of the consumer units, these estimates constitute averages
Table 3. Composition of two households and their consumption, expressed in money units, of three food items

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Household composition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>One adult</td>
<td>One child</td>
</tr>
<tr>
<td>Bread</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Milk</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Wine</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>15</td>
</tr>
</tbody>
</table>

for groups of food and people. If the intake of specific food items by individuals of a given household is of interest, a different type of study should be used (see Chapter 6). These extra inquiries, however, may overload participants in a household budget survey.

**The use of time series**

Household budget surveys carried out continuously or at frequent intervals open up a chance for time series analyses. Fig. 1 shows trends in consumption and price. Surveys more accurately describe trends than values for single points in time. Demand analysis also becomes possible; time series data on food prices and purchases from the same source can be used to estimate price and cross-price elasticities of demand and trends in demand (12). To compare budget survey data with those from other sets and from previous surveys, data on background variables such as region and socioeconomic factors should be disaggregated to the lowest possible level.

It should be mentioned that only an indication of the validity of household budget survey data can be obtained, because nothing is known about the validity of the reference data. If sales statistics, market surveys, food balance sheets and individual dietary surveys show similar trends, however, the budget survey data are very likely to be valid.

**Presentation of Results**

The many potential users of household budget survey data have specific wishes about presentation. No format can satisfy everyone. The most important information, on product expenditure and the quantity of food and nutrients available per average household, should therefore be published separately and as soon as possible. A
Fig. 1. Consumption of butter and margarine and relative price movements in the United Kingdom, 1951–1985

Source: Ministry of Agriculture, Fisheries and Food (11).
time lag of up to a year from the end of the field work to publication is acceptable to most users. In addition, nutritionists, economists and others should be able to gain access to the original data for further analysis. The producers and users of the data should cooperate in their interpretation. Disciplines may help one another in determining, for example, the statistical quality of the data and the meaning of the nutrition information.

Final Remarks

In some countries, the results of household budget surveys have an important place in a nutrition information system. This is particularly true of surveys carried out on a yearly basis, because trends in food consumption can be shown. Despite their limitations, data from budget surveys are an important addition to food balance sheet data, because they show the distribution of food in subgroups of households.

Since there is a trend towards the international comparison of data, the harmonization of data collection and presentation is clearly desirable. As a long-term goal, internationally accepted definitions should be made of food aggregates, socioeconomic characteristics, time coverage and degree of urbanization, at least. Existing efforts towards standardization, particularly those focusing on food composition, should be encouraged (4,5).

References


7. *Nutrition Experts of the League of Nations; scaling of consumption used in budget surveys to determine the units of consumption in the various households.* Rome, Food and Agriculture Organization, 1932.

8. **Engel, E.** *Die lebenskosten belgischer arbeiter-familien früher und jetzt* [Costs of living of Belgian working-class families, before and now]. Dresden, C. Heinrich, 1895.


Dietary surveys and the use of the results

J. Haraldsdóttir

Unlike food balance sheets and household budget surveys, which describe food supply, dietary surveys have as a main objective the giving of information on the actual intake of foods. Food balance sheets and household budget surveys are usually carried out at regular intervals, and for comparability it is crucial that they be carried out as uniformly as possible. Consequently, a general methodology and format can be worked out for the collection of data. For dietary surveys the situation is completely different. Many different methods are used, depending on the objective and circumstances of each survey. Thus, before applying the results of a dietary survey in another context, for example nutrition surveillance, the method used, the original objective and other details of the set-up of the survey must be made clear.

An important advantage of dietary surveys is that they supply data on the dietary intake of individuals. Thus both the mean and the distribution of a population’s intake can be calculated, as well as the intakes of different groups. In contrast, food balance sheets provide only rough averages of the amount of food available for the entire population, and household budget surveys cover only the average acquisition of food by a household. Thus, dietary surveys can provide a much more detailed picture of a population’s intake.

This chapter briefly presents the methods used in dietary surveys and points out their main advantages and disadvantages. The limitations of the methods and the selection of a suitable method are briefly discussed, as are the factors that should be taken into account before survey results can be used for nutrition surveillance. Dietary survey methods are dealt with at greater length in a recent manual (1) and in numerous reviews (2–5).
Methods

Two main categories are used: record and recall methods. Record methods collect information while food is eaten; recall methods collect information on past intake, such as that of the previous day.

Data are collected in different ways. With recall methods, subjects are interviewed or asked to fill in a questionnaire. The other type of method involves keeping a record of the food eaten. Today these records are usually written, most often by the subjects themselves, but may be taped or fed directly into a computer.

Record methods
These methods require subjects to keep records of everything they eat and drink. The three types of food record (by menu, household measures and weighing) differ in the precision of their estimates of quantities consumed. A fourth type is called duplicate portion analysis.

A food record by menu comprises only what is eaten, giving no information about quantities. A food record by household measures specifies quantities in terms of measures such as the number of cups, slices and spoonsful. A food record by weighing specifies quantities precisely, as everything eaten is carefully weighed. This is also called the weighed intake method.

In duplicate portion analysis, extra portions of all foods and drinks consumed (identical to those eaten and drunk) are collected for chemical analysis. This method is very expensive, and is therefore used only for special purposes, such as estimating intakes of a nutrient for which food composition tables do not have adequate data.

Sometimes methods are combined; for example, a record by menu may give the quantities of food items regarded as particularly important. The results are called semiquantitative records.

Recall methods
The three types of recall method are: 24-hour recall, dietary history and food frequency.

In the first type, subjects are asked to recall everything they consumed during a particular day, usually the day or 24 hours previous to the collection of the information. The method can be extended by repeating the recall a couple of times, and thus give information about more than one day for each subject. Subjects may be asked to recall their consumption over 48 hours but this is rather unusual. The information is preferably gathered in an interview, but a questionnaire may also be used.

A dietary history assesses the usual food intake of the subject during a long period, such as an average month. There are numerous
modifications of this method and the term is often used inappropri-ately. A true dietary history gives information both on meal patterns and total food intake. The information is usually collected in a personal interview, as other means would be very complicated.

In contrast, the food frequency method covers only part of the diet. Information is collected on how often certain foods are eaten, and sometimes on quantities consumed. Subjects may give this information in a questionnaire or an interview.

Advantages and Disadvantages

Record methods
The main advantages of record methods are their independence of subjects’ memory and their giving of accurate quantities. The main disadvantages of these methods are the large amounts of time and cooperation they require from the subjects, and the chance that they may influence food intake during the recording period. In addition, the more accurate the method, the heavier the demands on the subject. Food records by weighing are thus much more demanding than records by menu, for example.

The relatively heavy demands on subjects result in some limitations on the use of record methods. For example, the food record can only cover a limited number of days. This period may be too short to give information on the usual food intake of each subject. Further, the proportion of subjects dropping out of the survey is often relatively large. Record methods may thus be difficult to use in a survey designed to cover a random sample of the general population, as the loss of the drop-outs often biases a sample.

Recall methods
The main advantage of recall methods is the limited work required of the subjects. A high cooperation rate may thus be obtained, even in a random sample of the general population. In addition, these methods do not influence food intake during the study period. The most serious disadvantage of recall methods is their complete reliance on the subjects’ memory, which may be both insufficient and faulty. Further, the quantities of food consumed can only be estimated, not accurately measured.

Limitations

The differences in dietary survey methods are naturally reflected in the type and accuracy of the data that they supply. No method is
perfect; each has limitations. These are seldom obvious and must be borne in mind when the results of a survey are used.

First, some dietary surveys cover only parts of food intake. Those using food frequency methods, for example, collect data on the intake of foods selected for their importance to the particular objectives of the surveys. The results cannot therefore be used for calculating the intake of total energy or nutrients not covered by the surveys.

Second, some methods, such as the 24-hour recall, do not reflect individuals' usual intake. The number of days necessary for this task depends on the food or nutrient and the population in question; measuring usual energy intake, for example, typically takes seven days, but may take 36 days for vitamin C (2). The data from 24-hour recall surveys thus cannot be used to classify the subjects according to their intake, or therefore to estimate who is likely to be at risk.

Further, the results of dietary surveys may be used on four different levels to show:

- the mean intake of a group (level 1)
- the mean and distribution of intakes in a group (level 2)
- the relative intakes of individuals (level 3)
- the absolute intakes of individuals (level 4).

The four levels demand food intake data of very different types and quality. Level 1 makes the most moderate demands but also yields the least information. For example, interpretation at this level may reveal that the mean iron intake for a particular group is 19.3 mg per day for the men and 13.0 mg per day for the women. At level 2, the data would show not only the mean intake of vitamin C, for example, but the standard deviation from the mean or the distribution of intakes in percentiles. Levels 3 and 4 demand much more of the data.

Finally, although dietary surveys differ widely in the accuracy of their estimates of quantities of food eaten, these differences are usually invisible when the results are presented. Food records by weighing supply the most accurate data. At the other extreme are self-administered food frequency questionnaires with no questions on quantity; frequencies are converted to quantities by using standard portion sizes for all subjects. This practice may introduce a large or even systematic error. The accuracy obtained when such food models are used to estimate quantities depends upon their suitability for this purpose. Food models are often used in dietary history and 24-hour recall interviews.

Limitations in accuracy and in reflection of the usual diet greatly influence the validity of dietary survey methods. The validity and
reproducibility of the results of different methods are discussed in detail elsewhere (1,2) and are also dealt with to some extent in most review articles.

Selecting a Suitable Method for a Dietary Survey

In the absence of a perfect method, the selection of a suitable method for a dietary survey always requires the balancing of advantages and disadvantages. Callmer et al. (3) focus specifically on this topic, and Bingham (2) and Beaton (6) suggest suitable methods for different types of survey.

First, the objectives of the study must be sufficiently clear to indicate the type of data that the survey needs to obtain. Other factors to be taken into account are the characteristics of the target group and the resources available for the study.

The next step is the exclusion of obviously unsuitable methods. These may be rejected because of the purpose of the study, certain features of the target group or the size of the study. For a survey of several thousand people, for instance, the range of relevant methods is limited, as some would be too expensive.

Finally, one of the remaining methods can be chosen. Each should be considered in detail, and its advantages and disadvantages balanced against the priorities of the study. How important, for example, is a high participation rate in comparison with reliable information on quantities?

Using Survey Results in Nutrition Surveillance

The results of existing dietary surveys may be used for nutrition surveillance or in a nutrition information system, providing information on food intake and supplementing other information sources. A dietary survey undertaken specifically for these purposes has special status in this context, as the use of the results was considered in the survey design. This section deals only with the results of surveys undertaken for purposes other than nutrition surveillance.

Before it is decided to use the results of an existing survey, its suitability for that purpose should be determined. Six considerations are particularly important:

— the relevance of the survey population for nutrition surveillance;

— whether the survey reflects usual intake;
- the level of use of the results;
- whether the results can be used to calculate energy and nutrient intakes;
- the general unreliability of data on the intake of alcohol and other items; and
- the accuracy of the results.

**Relevance of the survey population**

A survey population is relevant for nutrition surveillance if it is: a random sample of the general population, or a sample of a group known to be a suitable indicator group for nutrition surveillance or a nutrition information system. In this context, information on the food intake of the general population is usually needed. Data from a few small surveys of different groups are therefore not sufficient. In some countries, however, certain groups may have been found to be suitable as indicators of the nutritional situation. A dietary survey including one of these indicator groups has particular value.

In addition, the results from several independent dietary surveys of different population groups may be combined if the survey designs are comparable. The sum does not, however, reflect a random sample of the general population. This is important to bear in mind when the results are evaluated for nutrition surveillance.

**Reflection of usual intake**

Food intake varies. The extent of the variation depends on the population in question. In western European countries, for example, day-to-day variation, particularly between workdays and weekends, is usually substantial. The food intake data most relevant to a nutrition information system are those on usual intake, and not that of a special season of the year or part of the week. Again, all dietary surveys do not supply these data.

A dietary survey in which the data were collected during a short period is prone to bias because of seasonal variations in intake, regardless of the collection method used. It should thus be borne in mind that such a survey gives information that reflects food intake only during the data collection period. Even with survey methods intended to describe the usual intake during a whole year (which dietary history or food frequency surveys may do), the data tend to be coloured by the season in which they were collected.

If food intake data for each subject cover only one or two days, it should be ensured that the group results reflect the whole week. This is possible if different subjects give information on different days, so that a reasonable distribution between all weekdays is obtained for
the group as a whole. It is often particularly important to check the proportion of workdays to weekend days.

**Level of use of the results**
In looking for information on food or nutrient intake, the important questions concern:

- the average intake of the survey group;
- the size of groups at risk (those with the highest or lowest intake); and
- the identity of individuals at risk (those with the highest or lowest intake).

The most relevant information is therefore the mean for the group (level 1), the mean and distribution within the group (level 2) and the ranking or classification of individuals (level 3). Before the results of a dietary survey are used on level 2 or 3, their suitability for this must be critically evaluated. Otherwise an erroneous picture of the risk group may result.

**Calculating energy and nutrient intakes**
It is often asked whether food intake results can be used to calculate the intake of energy and all other nutrients, because some dietary surveys are intended only to describe intakes of certain foods or of one or two nutrients. For this reason, such calculations must be made cautiously. Particular care must be taken when a food frequency method was used.

If energy intake and the intake of nutrients other than those included in the survey are to be assessed, the survey must cover the total food intake of the subjects. Further, the intake of other nutrients can also be assessed if the original survey covered at least the intake of all the foods known to be relevant for these nutrients, but this is only possible if the food tables contain adequate data on the nutrients.

Food frequency surveys never cover total food intake and thus rarely describe the intake of all the foods necessary to assess the intake of nutrients other than those included in the survey designs. The results of such surveys are therefore unsuitable for calculating intakes of total energy or other nutrients. Other dietary survey methods usually cover total food intake, but this must be checked before the results are used.

Further, in many countries calculations of the intake of certain nutrients, such as trace minerals, are not meaningful, owing to the lack of adequate data in the food composition tables (see Chapter 8).
Unreliability of data on the intake of alcohol and other items
Some countries may want to include alcohol intake in nutrition surveillance. Unfortunately, dietary surveys rarely supply reliable information on alcohol, although data may be included in the results of the survey.

Alcohol is one of the items whose usual intake is very difficult to assess. Others include sweets, snack foods and soft drinks. These are often consumed irregularly and on impulse, and their consumption is usually closely connected with moral judgements and thus may be inaccurately reported. Even surveys meant to cover total food intake, therefore, seldom supply reliable data on these items. Only surveys making special efforts to secure such data may be expected to give realistic assessments.

Accuracy of the results
Again, dietary survey methods vary widely in the accuracy of their results. Although these cannot be improved after the data have been collected, it is necessary to have an idea of their accuracy before deciding to use them. For nutrition surveillance, the relative accuracy of the results of different surveys must be determined, and surveys that are not comparable must be rejected.

Estimating the accuracy of dietary survey results is usually difficult, particularly for outsiders to the survey. Results from pilot studies, validity tests or other preliminary tests are valuable for this purpose; these may be available even if they have not been published. If no such results exist, however, a general evaluation must suffice.

Special attention should be paid to the quantitative accounts, the way in which the portion sizes were estimated. As mentioned, this factor may be a source of serious errors. The quantitative accuracy of food records by weighing is obviously superior to estimates using food models or household measures. The possibility of error is particularly large when no attempt was made to estimate individual portion sizes but the same standard portion sizes were used for everybody in the calculation of results.

References


6. **Beaton, G.H.** What do we think we are measuring? In: *Symposium on Dietary Data Collection, Analysis and Significance*. Boston, University of Massachusetts, 1982 (Research Bulletin No. 675).
Problems and pitfalls of food-to-nutrient conversion

L. Kohlmeier

Most commonly, nutrient rather than food intakes are the basis of evaluation of nutritional status, and rightly so. People's physiological needs are in the realm of molecules: vitamins, fats, carbohydrates and simple elements. In general, how they are combined in the creation of the interesting, colourful, flavourful, odoriferous and richly textured food products that people consume is of less physiological importance. Nutrients are essential for health. The amounts considered essential or desirable are based on the results of depletion and replacement studies of individual nutrients, and the consequences for the health of the subjects. Such studies form the basis of recommended daily allowances. Excessive intake is increasingly becoming a health concern expressed in various dietary recommendations (1,2).

In the study of diets, the conversion of the findings on foods into nutrients, which is necessary for scientific considerations, can be a costly, frustrating and demanding process (3–5). It may easily become too great a task for the user to accomplish. Further, major decisions, conclusions and advice may be based on the findings, and consequently depend on their validity. This chapter addresses the problems associated with converting food intake data into nutrients.

In its simplest form, the conversion of food intake information into estimates of nutrient intake entails multiplying the amount of a given food consumed by the amount of nutrient per unit of food eaten. Information on the food consumed and its nutrient content is the essence of the conversion. In practice, the process is riddled with potential pitfalls at all stages. These may hamper the process or affect the interpretability of the results. The information needs of the policy-maker or scientist determine the extent to which underlying assumptions can be met.
Assumptions in Food-to-nutrient Conversion

In the process of food-to-nutrient conversion, assumptions are generally made about:

- amounts (that the quantity of food consumed is known);
- waste (that, usually, no portions are discarded);
- detail (that the description of foods consumed is available and precise enough for adequate matching with the analytical results in food composition tables);
- completeness (that the dietary assessment method has captured information on all foods consumed);
- normalcy (that the information on intakes represents the normal or usual food habits for an individual or group);
- nutrient changes (that alterations in nutrient levels due to storage, processing, cooking, handling or other preparation are accounted for);
- values (that no values are missing, and accurate nutrient information is available on the foods consumed in the forms consumed);
- analogues and substitutes (that the nutrient information used is based on measurements of foods similar in composition to the foods consumed);
- database management and programming skills (that resources and skills are available to manage the task of conversion of food intake information through the use of nutrient tables); and
- the evaluation of intake data (that the calculated values of nutrients consumed reflect the levels available to the organism).

It is rare for all these assumptions to be justified. The acceptable tolerance limits depend on the intended use of the dietary data. The determination of mean intake levels of basic nutrients or energy for a group, for example, is less demanding than the determination of the size of the population at risk of zinc deficiency or aluminium excess.

The first five assumptions listed refer to the quality of information on the intake of an individual or population. Food balance sheets, for example, are notoriously weak on detail, waste estimations and amounts in general. Often household food consumption surveys describe individual intakes incompletely and inaccurately. Individual dietary recording tends to disturb the normalcy of behaviour.
The next three assumptions address the limitations of food composition tables and databases, and the common mistakes made in their application to population studies. The effort required to convert foods to nutrients is generally underestimated. Particular skills and resources are needed to complete the process when information becomes available. Finally, after data have been collected and analysed, the results have to be evaluated using appropriate dietary standards (see Chapter 10).

**Amounts: portion problems**

Precise information on the amounts of food consumed is absolutely essential in the conversion of foods to nutrients. Amounts may be measured, estimated, guessed at or based on some average portion size. Regardless of method, this information is always difficult to get.

Food balance sheets present quantities based on production, export, import and sales. They are quite remote from the individual's intake. Household food consumption surveys measure amounts entering the household, without consideration of how the food is prepared and distributed among family members, pets and guests. Even in studies of individuals, data on portion sizes vary in accuracy with the method used. Bias due to the inability to report accurately the amounts of foods consumed or changes in intake under observation needs to be recognized and considered in the analyses (5,6).

Another aspect of the difficulties with portion sizes is the misuse of amounts consumed. Inexperienced users of food composition data often handle amounts improperly. In the process of conversion, they may overlook the issues of waste, yield and wet versus dry weight.

**Waste**

Waste is the food not eaten by the people under investigation. It can take a number of forms: the edible food thrown in the dustbin or fed to the dog, the spoiled vegetables or mouldy bread, the trimmed portions of fruits and vegetables, the skin or bones of poultry, fish, beef or pork (which are prepared and wholly or partially eaten by some people, while considered inedible by others), and the fat on meat, if trimmed and not consumed separately.

Waste in relation to portion size deserves special consideration. Negligence in this regard obviously leads to overestimation. It can also result in faulty calculation of the relative composition of the diet. Taking account of discarded fat, for example, can result in drastically lowered percentages of energy consumed as fat. The failure to consider the bone weight of carcasses or T-bone steaks results in overestimations. Skin, peel and crust are likely to have different
nutrient compositions than their contents, and estimates of intake need to meet the assumptions in the nutrient tables.

Thus, using the example of a T-bone steak, if the food composition table considers the portion as purchased, and the individual reports the portion as consumed (without the bone), for accurate conversion the bone should theoretically be re-added and the total weight with bone estimated. A 200-gram steak with 50 g of bone has 9.9 g of fat and 20.9 g of protein per 100 g. The same steak without the bone has 12.9 g of fat and 27.9 g of protein per 100 g. One of these estimates requires adjustment before the table values are used, based on whether the bone is included in the purchase weight in the food composition table. The introductory chapters in food composition tables usually explain the basis of estimation, and therefore deserve careful reading before the values are used.

Degree of detail in food description
The degree of detail required on the type of foods consumed is determined by the goals of the study, which should be settled in advance. For example, the estimation of ratios of polyunsaturated to saturated fatty acid intake requires detailed information about levels of fat in foods and the types of oil and margarine consumed. The nutrients of interest to the study determine the degree of detail needed. This also depends on the main sources of the nutrient, and how widely distributed they are in the normal diet of the group under study.

Such considerations lead to an estimation of the number of items for which individual information is needed, and make possible the recognition of the types of acceptable information aggregation (food grouping). A sensible and well considered food grouping is important in the planning stage, since overdescription (the collection and coding of food in more detail than is required) is expensive and time consuming.

Ideally, each food consumed is matched with information on its nutrient content. Realistically, most people in individual-based studies are unable to given an accurate description of all the foods they consume. In studies on household level, the record keeper does not usually know exactly what other household members consume. And national food balance sheet estimates deal generally with broad food groups, not single food items.

To ensure proper matching of the food consumed to the closest similar food analysis, adequate detail is required, whether on cuts of beef, species of apple or the type and fat level of cheese. Of course, assumptions must often be made, since analytical values exist for only a small proportion of the foods available and may not even be of
recent date. This can be inconsequential for some nutrients but may result in extreme differences in others. The vitamin C content of apples, for example, varies by 100% between species, and the fat content of pigs has changed considerably in most European countries over the years.

Terminology is important in food description. Both within and between countries identical foods may have different names, or the same name may refer to completely different foods. When borrowing nutrient analyses from other countries, the researcher must be absolutely sure that the same recipe is used, or that the same parts of the ingredients are considered edible or discarded (7,8).

Completeness
Any estimation of nutritional adequacy needs to be based on an assessment of the total diet. A complete overview of the foods consumed is needed to calculate energy intake or the proportional intakes of fat, carbohydrate, protein and alcohol.

An assessment is equally important for the estimation of the micronutrient adequacy of the diet. An incomplete assessment may result in the overestimation of the size of inadequately nourished groups or, conversely, the underestimation of the size of groups consuming excess amounts.

Normalcy
Assumptions about the nutritional status of groups and consequent action need to be based on information that reflects the groups' normal or usual behaviour. People eat differently from day to day, have multiple suppliers of food, and travel. The selection and availability of foods are also influenced by economics, marketing influences and seasonal offerings. Typical eating behaviour is complex, requiring a broad base of information. The failure to include day-to-day variation in estimations of intake creates a risk of overestimating the number of people with low or high intakes. Many people "feast and fast", balancing their intake over days and longer periods, instead of consuming a constant level daily. Correction at a group level is possible if the individual variation is known (9). The ability of the various dietary assessment methods to replicate individual or group normalcy is an important point, discussed in Chapter 6 and elsewhere (9-11).

Nutrient changes
Most food composition tables provide information primarily or exclusively on the nutrient content of raw or unprepared foods. In general, information is not available on changes in nutrient composition
resulting from heat processing (cooking), water addition (boiling), fat addition (frying) or oxygen and light exposure (cutting, peeling).

The extrapolation of the changes in nutrient values during food preparation is difficult. Studies have shown that it can be done poorly at best, even with the most sophisticated of formulations (12–14). Still, the available information must be used to make adjustments for changes in the nutrients of critical importance to the analyses (13). Decisions must then be made about how generous the reduction for cooking losses will be estimated to be and how much moisture is assumed to disappear during preparation, for example, depending upon whether it is more prudent to err in a positive or negative direction.

In general, three factors need to be considered to ensure proper nutrient conversion:

- how the food composition table presents its data (whether on the basis of purchase weights or edible portions);
- what is actually discarded (such as apple and potato skins, the bones of fish and meat, trimmed fat, sauces, and broths and other fluids); and
- whether the yield estimates for prepared foods from raw ingredients have considered gains or losses of moisture and fat during their preparation (15).

**Missing values**

The lack of nutrient values for a food naturally hinders conversion. Nutrient information for some foods may be only partially available. Further, values may not be available for the prepared forms in which foods are consumed.

The problem of missing values can seldom be ignored. Calculating nutrient intake without compensating for these values gives a poorer estimate of the lower and higher ranges of possible intakes. The type of conclusion that would have to be made in these circumstances is that the population consumes at least 500 mg calcium per day on the average, but 10% of the frequently consumed foods containing calcium have not been included in the calculation. Estimates of the proportions of dietary energy derived from fats, carbohydrates, alcohol or protein cannot be made when values for these nutrients are missing, unless adjustments are made for them.

Adjustment means the replacement of the missing value with an educated estimate or an extrapolation from similar foods (16). When no data exist, estimation can be based on similar foods. It is advisable
to make adjustments based on water- or fat-free weights rather than equivalent total or wet weights.

**Analogues and substitutes**

No two foods are identical. The nutrient content of certain foods can change, and updated information may be scarce on the various foods consumed in a society. Analogues must therefore be used and substitution undertaken in nutrient conversion. Care must be taken in developing an appropriate strategy for the nutrient of interest.

To avoid the problem of missing values, assumptions are necessary about the similarity between foods. Further, the analyses available may have been made on species that do not reflect the local or predominant supply. Differences in soil, genetic strains or animal feed contribute to differences in the nutrient composition of similar types of food. Unfortunately, information on the source of food, the items sampled or the date of the analysis is seldom available. Two considerations are important when available information is used:

- whether the analysed foods are similar to the usual or the local food sources of the same type; and
- the extent to which foods of different types that are used for substitution have a similar content of the nutrient of interest.

If the food consumed includes, for example, a new type of cheese that does not appear in the tables, the question is whether its calcium content on the basis of its fat-free weight can reasonably be extrapolated from the known calcium contents of the fat-free weights of other cheeses.

**Database management and programming skills**

Anyone who has started from scratch on the task of food-to-nutrient conversion will attest to the need for a broad range of software to handle data collection, editing, recipe conversion, yield and retention factors, household measure amount conversions and the actual food-to-nutrient conversion. Statistical analytical tools are also required. An overview of the data files and software components required for an extensive dietary assessment system is found in Fig. 1.

If dietary data collection has been started without a full knowledge of what is required, the analysis may very often be bogged down for years or have to be abandoned (17,18). Particularly expensive and time consuming are the analyses of records of the nutrient intakes of individuals over a number of days (19,20).

Before beginning extensive efforts to construct a new nutrient database or convert foods to nutrients, the researcher should find out whether a system exists that is roughly appropriate for the needs of
Fig. 1. Components of an extensive dietary assessment system

Source: Hautvast & Klaver (5).
the study. The Eurofoods group can help in making contact. Inventories of databases, experienced users and software are available (21,22). This should be done early in the planning of the study.

Evaluation of intake data
Once estimates of intakes have been made, further steps are required to assess how closely intake reflects nutrient status (23). Factors affecting resorption, transport and storage may increase or inhibit nutrient sufficiency. The growing knowledge of the effects of inhibitors and enhancers of resorption, for example, has already led to recommendations to determine the adequacy of dietary iron based on haem iron and vitamin C intake (24).

Use of Food Composition Tables
At least 160 food composition tables are available in print, providing nutrient composition values for a number of foods. A comparison of those widely used in Europe shows that on average they contain 700 foods and 45 nutrients (25).

Simply multiplying the number of tables by the number of foods contained, however, does not give an estimate of the total wealth of information on food and nutrient composition. Most of the foods in the tables are actually replications of the primary foods presented in other tables, and the values are largely borrowed from a common source, most often the tables of the US Department of Agriculture or Souci et al. of the Federal Republic of Germany (26). The multiplication of the number of foods by the number of nutrients in a table is also inappropriate, since tables rarely present all nutrients for all foods. Further, many values are missing.

It should be realized that the analytical information presented in a table is usually edited by the authors of the work and drawn from numerous sources. Few tables are based only on original analytical values. Differences in language and terminology, table formats and structures, and underlying assumptions may also hinder foreign users from accurately employing the information provided. As already stated, a thorough reading of the introductions to tables is essential (25).

Conclusion
Food-to-nutrient conversions are fraught with pitfalls. An awareness of the issues should not paralyse potential users but stimulate them to
greater meticulousness, and thus improve new conversions and the interpretation of earlier results. The people who do this thankless task deserve credit, as it is a unique and essential component of a nutritional information system.

References


Database requirements for calculations from food balance sheet data and household budget surveys

D.A.T. Southgate

Food Balance Sheets

Food balance sheet data can provide useful information for makers of food and nutrition policy. In making calculations from data of this kind, the limitations of the data must be recognized and dealt with, while the maximum valid use is made of the data. Calculations of nutrient values from food balance sheets ideally require a special food-to-nutrient conversion database. This could be a subset of a comprehensive food composition database with particular constraints. In practice, a separate database for this type of conversion is desirable. The characteristics of such a database should be related to the food items it contains, the range of nutrient values included and the calculations and analyses for which it can be used.

Food items and their description

Food balance sheets are usually compiled at the wholesale or commodity level and are thus highly aggregated. They usually allow for non-human food use and may include some projections of obligatory processing losses. As the data are compiled at a level before foods are processed, they do not include estimates of losses of nominally edible material that take place as the commodity moves down the food chain.

The food categories measured are limited to major commodity groups, so the items in the database should correspond closely to these categories. For nutritional purposes, some may differ in
composition, and categories should be divided to present food items in a coherent way when possible. For example, meats need to be separated into beef, sheep meat and pig meat because of their distinctive fat composition.

The nomenclature for the items should be that used at the measurement level; that is, the descriptors of the system should be closely related to the measurement level. Within the European Community, the nomenclature in the common customs tariff register could provide the basis for naming food items. The database would therefore contain a limited number of food categories; probably 200–500 items would represent the measurements in sufficient detail.

**Nutrient coverage**

At present, nutrient calculations from food supplies are limited to energy value and the macronutrients: protein, fat and total carbohydrate. This level of measurement cannot really estimate losses of edible food or of labile constituents in the course of storage and processing. Detailed calculations may not be logically valid and computing nutrient provision in great detail may not be meaningful. A specific data file is thus desirable, to prevent the computation of unsound values.

It would, however, be desirable and possible to extend nutrient coverage to include a breakdown of fat into the main groups (saturated, monounsaturated and polyunsaturated fatty acids), and to break down carbohydrates into sugars and complex polysaccharides and, when data become available, into starch and various types of dietary fibre.

**The database and its use**

Thus, an appropriate database would have a maximum of 500 items with 10 categories: energy, protein, total fat and saturated, monounsaturated and polyunsaturated fatty acids, and total carbohydrate and sugars, starches and dietary fibre. A database of this size would probably suffice both in the European context and at the global level. It could be used on personal computers of modest capacity.

In addition to computing total supplies in terms of nutrients, for expression on a per caput basis or per weighted consumption unit (according to the demographic structure of a population), such a database makes it possible to describe dietary patterns in terms of nutrients. As mentioned in Chapter 4, food supply data describe food or nutrient availability, not consumption. The dietary pattern when expressed in terms of nutrients is, however, likely to be more representative of what is actually consumed than a pattern expressed in terms of foods. Dietary patterns can also be computed for food items
and food groups. The latter would demand a multidimensional analysis of manageable proportions, although in principle, where $n$ is the number of food items, analysis in $n-1$ dimensions is possible.

Comparisons of dietary patterns and disease incidence may provide more information than an analysis by macronutrients as percentages of energy. This latter approach is simple and two-dimensional; it inadequately describes the intrinsic variations in the composition of dietary intake. As mentioned earlier, such comparisons should be made only to generate hypotheses.

**Household Budget Surveys**

Household budget surveys measure food consumption at the retail level. Although many studies include allowances for inedible material in the foods as purchased, they can provide only approximate estimates for the differences in nutrient content between foods as purchased and as consumed. Household budget surveys also have specific database requirements, to meet the constraints of the level of measurement and to keep the calculation of nutrient composition within logical limits. These requirements are related to the number of food items and their identification, the range of nutrients in the database and the range of possible statistical analysis.

**Food items**

The number of foods available at retail level is very large if all different brands are noted. Analyses of dietary intakes, however, show that about 200 food items account for 80–90% of total food consumption in most communities (1). The level of accuracy in identifying foods and recording the amounts purchased is such that generic names for food items can be used in many studies, provided that the foods covered are compositionally similar. Variations between the brands or grades of many foods are not significant when judged against the precision of the recording of the aggregated consumption of a household. A database of, say, 1000 food items would thus describe the nutrient consumption of households with reasonable reliability. In addition, the use of weighting factors to compensate for differences in the structure of the household by age, sex and number of members indicates the limited precision and accuracy of household budget survey calculations. A highly detailed database with large numbers of foods might give a spurious indication of improved accuracy. Stockley et al. (2) found that recording individual intakes using 60 food groups gave a description of nutrient intake judged by duplicate diet analysis to be of equal or greater accuracy than that of a more detailed database.
Nutrient coverage
Owing to the amounts lost to waste, the effects of food preparation on nutrient content cannot be very accurately described at this level. For example, the intake of vitamin C and (probably) folates is known to be difficult to determine by calculation, and sodium chloride levels vary greatly: strong reasons for excluding these nutrients from analyses of household budget surveys. If these nutrients are included, however, the database programs should automatically generate caveats for the user, indicating that the values are approximate. An automatic rounding step could be included in the programs, to prevent a spurious impression of accuracy. A reasonable number of nutrients should be covered: complete moisture, protein, fat, the major fatty acid groups, sugars, starches, dietary fibre, the major minerals (potassium, calcium, phosphorus, zinc, and sodium and iron with caveats) and the major vitamins (vitamin A, the carotenes, vitamins D and E, thiamine, riboflavin, niacin, vitamin B₆, and vitamin C and folates with caveats).

Calculations and analyses
The supply of nutrients to the members of the household cannot be directly computed. Weighting may be done, based on requirements by age, sex or body size, assuming that the total household food supply is distributed according to these requirements. It has been shown, however, that this assumption is invalid for a range of nutrients. The use of consumption weightings (see Chapter 5) is therefore only a general guide as to the adequacy of food supply to household members.

Like food balance sheets, household budget surveys, by providing dietary patterns broken down into the major food groups, are a potential tool for multidimensional analysis (defined by n – 1 dimensions, where n is the number of food groups). Such analysis may give more information than an analysis by protein, fats and carbohydrates expressed as percentages of energy.

Detailed multidimensional analysis using values for several nutrients could also be a useful tool. The analysis of variance should be used to establish covariances to restrict the number of dimensions.

Format of a household budget database
Because the nutrient coverage would be comparable to that of most comprehensive databases, a household budget database could be contained within any major nutrition database. Within a single market, such as that proposed for the European Community, however, a single database at this level could be constructed that would be of a size (say, 5000 food items) to be contained in
in personal computers. It could thus be widely used. It may be advantageous, therefore, to separate foods as purchased into a discrete data file for household budget surveys.

References


Comparison of dietary data from different sources: some examples

W. Sekula, W. Becker, A. Trichopoulou & G. Zajkas

In general, available dietary data represent different levels in the food distribution chain and are obtained by different methods. As emphasized in preceding chapters, the data therefore give different information. In most countries, data are not available from all levels at the same time. Some countries, for example, do not compile food balance sheets, and must rely on those published by FAO or OECD or household budget surveys. This chapter compares some dietary data from different sources to illustrate their differences and similarities.

FAO and OECD Food Balance Sheets

Information on an international level on per caput supplies of food and nutrients is published by FAO (1) and OECD (2).

OECD food balance sheets
As the FAO food balance sheets are described in Chapter 4, a short description of the OECD food balance sheets is provided here. In the mid-1950s, OECD started to publish the food balance sheets received each year from its member countries. Until 1967, each issue contained only a small amount of annual data. In 1968, the series received the title it bears today. Since then, seven additional volumes have been printed, with considerable overlapping of the periods covered:
The OECD food balance sheets cover 23 countries: Australia, Austria, Belgium and Luxembourg (in the Belgo–Luxembourg Economic Union), Canada, Denmark, Finland, France, the Federal Republic of Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States and Yugoslavia. All member countries are covered, with the exception of Greece and Iceland. Although OECD claims that food balance sheets do not exist in these countries, both are included in the FAO statistics. With the exception of Turkey, all these countries may be said to have developed market economies. The coverage in the OECD food balance sheets thus differs considerably from that of FAO, whose most recent report included nearly 150 countries (1).

OECD gets its data from replies to a questionnaire on food balance sheets sent annually to national government agencies. For the European Community, extensive use is made of data that the member states send to the Statistical Office of the European Communities. For each country, the OECD publications give explanatory notes on the reference period and the source of information that has been used.

The total availability of a particular commodity is the sum of production, stock variation and import figures, minus those for export. Utilization comprises feed, seed, processing into food products, processing into industrial products, waste and statistical differences. According to OECD, total availability minus utilization gives gross human consumption. In turn, net human consumption corresponds to gross human consumption multiplied by the extraction rate. Some products are processed before consumption, which eliminates part of the weight shown under gross human consumption. For example, the milling of cereals before consumption reduces their

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*Monnier, T., Head, External Relations Division, OECD (personal communication).*
original weight by roughly a quarter. The percentage given as the extraction rate is the coefficient by which the initial weight must be multiplied to obtain the weight remaining after processing (2).

Per caput consumption is estimated by dividing net human consumption by population. OECD employs two concepts: de facto population, which means the people actually present in the country on the date of census, and de jure population, which means the people domiciled in the country on the date of census. Per caput consumption is expressed in kilograms per year and in grams per day. The per caput consumption of energy, protein and fat is calculated using nutrient conversion factors that are given in the OECD publications.

OECD food balance sheets are quite similar in presentation to those of FAO. This is not surprising; owing to FAO’s efforts countries use a uniform technique to construct their food balance sheets. The fourth session of the FAO Conference adopted a resolution recommending that governments be encouraged to develop their own food balance sheets, and that FAO be prepared to assist those that found the task difficult (3). This led to the publication of a handbook for use by countries (4). Some minor differences, such as in the definitions used, persist between the FAO and OECD food balance sheets. While FAO uses such terms as stock changes and domestic supply, OECD refers to stock variations and total indigenous consumption.

Comparative Analysis of FAO and OECD Data

This analysis is based on data from recent FAO and OECD publications (1,2). The comparison is limited to European OECD member countries. Data on per caput energy, protein and fat supply in these countries are included. The FAO figures were published as three-year averages, but the three-year averages for the OECD figures have been calculated by the authors.

Commodities

The OECD commodity list covers more than 70 items in 13 categories. The FAO list is more comprehensive, including about 300 items in 17 categories. Although a single country’s food balance sheet never includes all these items on either list, the greater amount of detail makes the FAO list more informative.

The two commodity lists differ mainly in the grouping, treatment and presentation of the products (Table 1). Further, the commodity groups used by FAO include such categories as spices, stimulants and alcoholic beverages, which are not taken into account by OECD. As
Table 1. The presentation of various food groups in FAO and OECD food balance sheets (FBS)

<table>
<thead>
<tr>
<th>Food group</th>
<th>Presentation in FAO FBS</th>
<th>Presentation in OECD FBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>Cereals (expressed as whole grains)</td>
<td>Cereals (expressed as flour and grains)</td>
</tr>
<tr>
<td>Sugars</td>
<td>Raw sugar, confectionery, syrups and other sugars, and honey</td>
<td>Refined sugar, syrup and honey</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Potatoes</td>
<td>Potatoes and potato flour</td>
</tr>
<tr>
<td>Pulses</td>
<td>Dry beans and peas</td>
<td>Pulses</td>
</tr>
<tr>
<td>Nuts</td>
<td>Nuts and oilseeds</td>
<td>Tree nuts, chestnuts</td>
</tr>
<tr>
<td>Vegetables and fruits</td>
<td>Fresh, dried and prepared vegetables and fruits (including juice)</td>
<td>Fresh and canned vegetables and fruits (expressed in terms of product weight for the European Community)</td>
</tr>
<tr>
<td>Meat</td>
<td>Meat (expressed in carcass or eviscerated weight) and offals (expressed in product weight)</td>
<td>Meat (expressed in carcass or eviscerated weight) and offals (expressed in product weight)</td>
</tr>
<tr>
<td>Fish</td>
<td>Fresh fish and products (expressed in whole fresh weight)</td>
<td>Fresh fish and products (expressed in various ways)</td>
</tr>
<tr>
<td>Milk</td>
<td>Fresh milk, cream, whey, whole cow's milk, cheese</td>
<td>Whole milk and products, (including milk for cream production, and skim milk and products), cheese and dry milk</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>Margarine, vegetable oil, butter and other animal fats (expressed in product weight)</td>
<td>Butter and margarine (expressed in product weight), total fat (expressed as pure fat)</td>
</tr>
<tr>
<td>Alcoholic drinks</td>
<td>All malt beverages, wines and spirits</td>
<td>All malt beverages and wine</td>
</tr>
</tbody>
</table>

the energy value of alcohol is considerable, it may contribute quite significantly to the differences in total energy availability between some countries in Europe. The inclusion or exclusion of alcohol may thus result in noticeable differences in the data for such countries.

Fig. 1–4 compare per caput supply for some commodities in 18 European countries (data on two are combined in the Belgo–Luxembourg Economic Union). In all countries except Turkey, FAO food balance sheet data show significantly higher per caput supplies of cereals than the OECD data (Fig. 1). Further, the OECD data on cereals fluctuate greatly from one year to the next. The per caput supply of wheat in Turkey in 1979, for example, increased by about 20% in comparison with the previous year, decreased by 20% in 1980 and remained stable in 1981. The cereal supply in Belgium and Luxembourg which had remained stable for several years at about 70 kg per caput, suddenly dropped to 53 kg in 1979 and rebounded to 70 kg in 1981–1982. In Norway a similar sudden fall occurred between 1981 and 1982.

The two sources give more similar data on egg supply (Fig. 2). Fig. 3 and 4 illustrate the large differences in the data on fruits and vegetables. There are also variations in the data on such commodities as potatoes, sugar, meat and milk.

There may be several explanations for these differences. The first concerns commodity coverage and classification. According to FAO, the large differences in the figures shown for fruits and vegetables for Turkey, for example, are probably due to a different classification of water melon. FAO considers it a fruit, but it is often regarded as a vegetable. As a matter of fact, however, FAO and OECD give almost identical aggregate figures for fruits and vegetables. Still, the problem of differences between the data sets requires further analysis.

Nutrients
Fig. 5–7 show differences in the per caput availability of energy, protein and fat in the same countries. To ensure comparability, alcohol is excluded from the FAO data. The OECD figures are higher for most of the countries. The differences are often considerable.

Interestingly, there is no pattern in the differences between the data that might point towards any systematic cause. Turkey provides an extreme example. The figures for energy and protein supplies in Turkey are among the highest in the OECD data and the lowest in the FAO data. The high energy supply in the OECD data is mainly caused by the very high but unlikely supply of wheat in 1979. This observation has serious implications; the two data sets can lead to very different conclusions.
Differences appear even in relative figures, such as the percentages of total energy derived from protein (Fig. 8) and fat (Fig. 9) or the composition of the energy supply. In 11 countries, the proportion of energy from fat is higher in the OECD data; correspondingly, the proportion of energy derived from carbohydrate is higher in the FAO data in 13 countries. In fact, comparisons between countries show that, with only a few exceptions, all figures differ between the two data sets.
The differences in the relative proportions of energy from nutrients are mirrored in commodity groups. The contributions to total energy from cereals, potatoes and sugar are usually higher in the FAO figures. The main reasons for such differences are differences in commodity supply and food-to-nutrient conversion factors. The higher supply of protein in the OECD data set is partly due to the higher figures for milk supply. The higher fat supply in many countries in the OECD data is more difficult to explain. It may be due
Fig. 3. Per caput supply of fruits according to FAO and OECD data, 1979-1981 averages

<table>
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<tr>
<th>Country</th>
<th>FAO data</th>
<th>OECD data</th>
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Source: FAO food balance sheets, 1979-81 average (1) and OECD food consumption statistics 1973-1982 (2).

in part to different conversion factors. Of course, the differences in energy supply reflect the cumulative differences in fat, protein and carbohydrate supply.

Conclusions
Although compiled in a similar way, the food balance sheets published by FAO and OECD are not identical. They differ in the coverage, grouping and level of processing of commodities, and
Fig. 4. Per caput supply of vegetables according to FAO and OECD data, 1979–1981 averages

![Vegetables per Caput Supply](chart.png)


possibly in nutrient conversion factors. As a result, different figures are given for most countries in the per caput supply of certain commodities and the total energy and nutrient supplies. A comparison of the food and nutrition situation between countries should therefore be based on data from only one of these sources. The FAO data have the advantage of covering a larger number of countries. Further efforts should be made to explain the differences between the data sources and to increase their comparability.
Fig. 5. Per caput supply of total energy according to FAO and OECD data, 1979–1981 averages

<table>
<thead>
<tr>
<th>Country</th>
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<th>OECD data</th>
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<tr>
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<tr>
<td>BEL &amp; LUX</td>
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</table>

*Note.* Alcohol is not included.


**Comparison of FAO and National Data: Some Examples**

In many countries, national food balance sheets are available in addition to those published by FAO and OECD. In general, the data are found in national statistical yearbooks or special statistical publications. The comparisons of national and FAO data for Poland, Sweden and other European countries in this chapter are intended to
Fig. 6. Per caput supply of protein according to FAO and OECD data, 1979–1981 averages

<table>
<thead>
<tr>
<th>Protein (g per caput per day)</th>
<th>AUT</th>
<th>BEL &amp; LUX</th>
<th>DEN</th>
<th>FIN</th>
<th>FRA</th>
<th>DEU</th>
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Note. Alcohol is not included.


demonstrate the need for a detailed knowledge of these sources to underlie their use. Differences between countries are highlighted, not to cast doubt on this type of food information but to illustrate its range of variation.

Swedish food balance sheets
The Swedish Agricultural Marketing Board (SAMB) is responsible for the compilation of food balance sheets in Sweden. Their data go
Fig. 7. Per caput supply of fat according to FAO and OECD data, 1979–1981 averages

Note. Alcohol is not included.


back to 1939, but older data are available from other sources. The statistics are published annually in a statistical yearbook. More detailed figures are published in the Journal of agricultural economics and special reports issued by SAMB.

The methods for compiling the data were thoroughly revised in the middle of the 1960s. Since that time, SAMB has used two concepts in its calculations: direct consumption and total consumption (5).
Fig. 8. Percentage of total energy derived from protein according to FAO and OECD data, 1979–1981 averages

<table>
<thead>
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<th>Country</th>
<th>FAO data</th>
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Note. Alcohol is not included.


Total consumption is defined as the total amount of raw material available for human consumption. It includes products that are delivered to the consumer in an unprocessed form, as well as the raw materials and the semiprocessed products used by the food industry. Total consumption is usually calculated from production data, which equals the amount of food harvested, slaughtered or caught, corrected for trade and stock changes. In many cases, sales figures are used instead of production figures. No corrections are made for waste. For
Fig. 9. Percentage of total energy derived from fat according to FAO and OECD data, 1979–1981 averages

<table>
<thead>
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<th>Country</th>
<th>FAO data</th>
<th>OECD data</th>
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Note. Alcohol is not included.


most commodities, the figures for total production are usually expressed in a primary commodity equivalent and seldom in a product equivalent.

Direct consumption comprises the total amount of food delivered from producers to private households and the catering sector. It includes estimates of home production, such as the retention by producers of milk for their own consumption, the home growing of vegetables and fruit, berry picking, hunting and fishing. As far as
possible, quantity figures represent the form in which products reach the consumer, and refer to net weights. This means that corrections are made for waste during trade, distribution and storage. These reductions are usually based on estimates made in consultation with associations of food producers and food companies. They are less often the result of objective measurements. The figures used for waste vary according to the level in the distribution chain at which the original data were collected. Waste and storage changes in private households and the catering sector are not accounted for. Most of the figures used in establishing direct consumption refer to processed products, which make up about 85% of the energy supply.

Figures for direct and total consumption, compiled according to the revised methods, are available from 1960 onward. The older data include fewer products and are closer to the total consumption level.

Since 1960, data on energy and some nutrients (protein, fat, carbohydrate, vitamins A and C, thiamine, iron and calcium) have been calculated from the direct consumption figures. Energy and nutrient conversion factors have been derived from Swedish food tables.

**Polish food balance sheets**

Data on the per caput supplies of the basic food groups are regularly published in statistical yearbooks edited by the Central Statistical Office. The data that appeared in the yearbooks published before the Second World War were limited to meat and sugar. Data on the supply of several additional food groups were published in 1946 and regular annual presentation began in 1950. By 1970, there were data on cereals, potatoes, meat and offal, fish and fish products, fats and oils, milk and milk products, hen eggs and sugar. Since 1970, fruit and vegetables have also been included. Data on subgroups in some of these groups are also available: rice, pork, beef, poultry, saltwater fish, animal fats, vegetable oils and fats, and butter.

Data on the supply of cereals and potatoes relate to crop years; data on the remaining food groups relate to calendar years.

The figures on per caput food supply in Poland are derived by using the following scheme. The available supply equals: production plus imports minus exports plus stock changes minus domestic utilization (seed, feed, processing into non-food commodities) minus losses in production, transport, processing and distribution. Polish statistical yearbooks do not yet contain data on the per caput supply of energy and nutrients. These are published in the scientific literature. The Food Economics Division of the National Institute of Food and Nutrition, Warsaw, regularly publishes data on the energy and
nutrient content of the available food supply. The nutrients covered are animal and vegetable protein, carbohydrate, fat, calcium, phosphorus, iron, magnesium and vitamins A and B₁, niacin and vitamin C.

Comparison of food balance sheets from different sources
In general, the FAO food balance sheets present more detailed information on commodities than national food balance sheets. FAO publishes data on more commodity groups and more individual commodities within the groups. Most commodities are expressed in a primary commodity equivalent, except for sugar, oils and fats, and beverages. In the national food balance sheets, the level of processing for different commodities varies (1,5–7). Commodities such as cereals, sugars, fish, milk, fats and oils are often presented differently (Table 2).

Table 3 shows national data for the per caput supply of some commodity groups in relation to the figures presented by FAO (1,5–8). The differences can be explained in part. The FAO figures for cereals are higher than the national ones, partly because the FAO figures represent unmilled grain. The figures for sugar are somewhat lower in the national food balance sheets because FAO data mainly refer to raw sugar. FAO gives lower figures for the supply of potatoes; the reason for this is unknown. Both Polish and Swedish figures for milk and milk products are higher than those of FAO. In the case of Sweden this is because the FAO figures exclude fermented products and probably include only the hard, full-fat types of cheese. The Polish figures represent milk and products as whole milk equivalents, which lead to much higher figures than those presented by FAO. The Polish figures for fish are lower than those given by FAO, mainly because the former are expressed by product weight and the latter as whole fish.

Energy and nutrients
Table 4 shows the average supply of energy, protein and fat in four countries from which reasonably comparable data are available (5,9–11). No definite trend emerges when the national and FAO figures are compared. The largest differences are in the fat supply. FAO gives higher figures than the Swedish food balance sheets for the per caput supplies of energy, protein and fat. Fig. 10 shows the contribution of fat to total energy in Sweden; the two data sets first show a similar, rising trend and then diverge.

There are several reasons for these differences. One is the basic statistics, or the way of expressing various commodities. The differences in the level in the consumption chain to which the data
### Table 2. The presentation of various food groups in FAO and Polish and Swedish food balance sheets (FBS)

<table>
<thead>
<tr>
<th>Food group</th>
<th>Presentation in FAO FBS</th>
<th>Presentation in Polish FBS</th>
<th>Presentation in Swedish FBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>Cereals (expressed as whole grains)</td>
<td>Cereals (expressed as flour)</td>
<td>Cereals (expressed as flour and grain)</td>
</tr>
<tr>
<td>Sugars</td>
<td>Raw sugar, confectionery, syrups and other sugars, and honey</td>
<td>Refined sugar (including that used for processing into food commodities), syrup, and honey</td>
<td>Refined sugar, syrup, and honey</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Potatoes</td>
<td>Potatoes</td>
<td>Potatoes</td>
</tr>
<tr>
<td>Pulses</td>
<td>Dry beans and peas</td>
<td>Not included</td>
<td>Included as fruit</td>
</tr>
<tr>
<td>Nuts</td>
<td>Nuts and oilseeds</td>
<td>Not included</td>
<td>Included as fruit</td>
</tr>
<tr>
<td>Vegetables and fruit</td>
<td>Fresh, dried and prepared vegetables and fruits (including juice)</td>
<td>Fresh and processed vegetables and fruits (expressed in fresh equivalent)</td>
<td>Prepared vegetables and fruits (expressed in product weight)</td>
</tr>
<tr>
<td>Meat</td>
<td>Meat (expressed in carcass or eviscerated weight) and offals (expressed in product weight)</td>
<td>Meat (expressed in carcass or eviscerated weight) and offals (expressed in product weight)</td>
<td>Meat (expressed in carcass or eviscerated weight) and offals (expressed in product weight)</td>
</tr>
<tr>
<td>Fish</td>
<td>Fresh fish and products (expressed in whole fresh weight)</td>
<td>Fresh fish (expressed in product weight, including that used in processing)</td>
<td>Fresh fish and products (expressed in whole fresh weight)</td>
</tr>
<tr>
<td>Milk</td>
<td>Fresh milk, cream, whey, whole cow's milk, cheese</td>
<td>Fresh milk and milk products (expressed in whole milk equivalents)</td>
<td>Milk (including all milk products except whey)</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>Margarine, vegetable oil, butter and other animal fats (expressed in product weight)</td>
<td>Vegetable oils and fats, butter and animal fats (expressed in product weight)</td>
<td>Margarine, minarine, butter and vegetable oil margarine, vegetable oil and butter (expressed in product weight)</td>
</tr>
<tr>
<td>Alcoholic drinks</td>
<td>All malt beverages, wines and spirits</td>
<td>Beer, wines and spirits</td>
<td>All malt beverages, wines and spirits</td>
</tr>
</tbody>
</table>

Table 3. Per caput supply of food groups in Polish, Swedish and Norwegian food balance sheets, expressed as percentages of FAO figures, 1979–1981 averages

<table>
<thead>
<tr>
<th>Food group</th>
<th>Supply</th>
<th>Poland</th>
<th>Sweden&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Norway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td></td>
<td>69</td>
<td>75</td>
<td>76</td>
</tr>
<tr>
<td>Sugars</td>
<td></td>
<td>92</td>
<td>95</td>
<td>98</td>
</tr>
<tr>
<td>Potatoes</td>
<td></td>
<td>134</td>
<td>113</td>
<td>90</td>
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<tr>
<td>Vegetables</td>
<td></td>
<td>99</td>
<td>88</td>
<td>108</td>
</tr>
<tr>
<td>Fruit</td>
<td></td>
<td>100</td>
<td>102</td>
<td>95</td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td>100</td>
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<td>97</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
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<td>92</td>
<td>64</td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td>100</td>
<td>107</td>
<td>108</td>
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<tr>
<td>Milk</td>
<td></td>
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<td>Fats</td>
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<td>109</td>
<td>95</td>
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<sup>a</sup> Figures refer to total consumption data.

Table 4. Data on the per caput supplies of energy, protein and fat in four countries, according to FAO and national food balance sheets (FBS), 1979–1981 average

<table>
<thead>
<tr>
<th>Country</th>
<th>Energy (MJ(kcal))</th>
<th>Protein (g/day)</th>
<th>Fat (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAO FBS</td>
<td>National FBS</td>
<td>FAO FBS</td>
</tr>
<tr>
<td>Norway</td>
<td>14.2 (3390)</td>
<td>12.7 (3040)</td>
<td>101</td>
</tr>
<tr>
<td>Poland</td>
<td>14.0 (3340)</td>
<td>14.7 (3510)</td>
<td>108</td>
</tr>
<tr>
<td>Sweden</td>
<td>12.6 (3000)</td>
<td>12.3 (2950)</td>
<td>89</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>12.7 (3040)</td>
<td>12.2 (2910)</td>
<td>89</td>
</tr>
</tbody>
</table>

Note. Alcohol is not included.
Fig. 10. Percentage of total energy derived from fat in Sweden according to FAO and Swedish food balance sheets, 1935–1982

FAO data

Swedish data

Note. Alcohol is not included.

Source: Becker (5).

refer are also important. Further, different conversion factors for energy and nutrients might, in addition to the differences in food supply data, explain some of the observed inconsistencies. The figures, therefore, are not always directly comparable, although the trends are rather similar.

The higher supply of fats shown for Polish food balance sheets in Table 4 is due to a higher figure for the fat content of meat in Polish tables than in FAO tables. The situation is reversed for Sweden: the
actual fat content in Swedish meat is lower than in the FAO tables. The figures for protein supply are more similar, although FAO gives a higher figure for Norway and Poland than do the national data, which is difficult to explain.

FAO has also published food balance sheet data on the supply of fatty acids (8). A comparison of some of these data with available Swedish data (5) shows that the FAO data on fatty acid composition remain almost the same from the mid-1960s to the mid-1970s, while the Swedish data show a higher proportion of polyunsaturated fatty acids in 1975 than in 1965 (Table 5). This could indicate that FAO has had limited information on the fatty acid composition of Swedish margarines. In addition, FAO calculations are based to a larger extent on raw materials commonly used in the production of shortenings.

FAO continuously publishes data on the availability of some vitamins and minerals (12). It does not, however, take account of fortification, which in Sweden contributes significantly to the supply of iron and several vitamins. When this is considered, as well as the fact that different food tables are used, it is not surprising that most of the FAO figures differ from the Swedish, even when values are expressed in relative terms. As shown in Fig. 11, FAO figures on the iron content of the diet remain on a rather constant level; the Swedish data give a rising trend, caused by the fortification level in flours, which was increased twice between 1960 and 1975.

Fig. 12 shows the availability of calcium according to the FAO and Swedish data. Here the two data sets are rather similar, because of similar values for the supply of milk products and comparable calcium values in the food tables.

**Comparison of Data from Different Levels of the Food Chain**

Food balance sheets represent data collected at the point farthest from consumption, as they are based on food supply information available on a national level. Not surprisingly, the figures are usually somewhat lower when data are collected at household level, and lower still when data are collected on an individual level. This is to be expected; it is no reason for discarding any of the data sets as imprecise. Each data set must be interpreted and used for the information it actually yields.

Food balance sheet data are very useful for a nutrition policymaker, as they allow monitoring to determine whether nutrition policy objectives at population level are being met.
Table 5. Percentage composition of available fatty acids in the Swedish diet, according to FAO and national food balance sheets, around 1965 and 1975

<table>
<thead>
<tr>
<th></th>
<th>1965</th>
<th>1975</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAO data</td>
<td>Swedish data</td>
</tr>
<tr>
<td>Saturated</td>
<td>45</td>
<td>54</td>
</tr>
<tr>
<td>Monounsaturated</td>
<td>41</td>
<td>38</td>
</tr>
<tr>
<td>Polyunsaturated</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>P:S ratio</td>
<td>0.30</td>
<td>0.17</td>
</tr>
</tbody>
</table>

* Values from 1965–1968.

Source: Becker (5).

Household budget survey data can give information about the dietary patterns of groups, making distinctions between geographical regions, income brackets and family structures. Sometimes still finer socioeconomic distinctions can be made, depending on the structure of the investigation. These data sets can give information about equity issues, and may indicate vulnerable or risk groups, or simply describe differences.

Only individual level surveys can relate dietary pattern to health indicators. If a representative sample of the population is surveyed, the distribution of intakes of different nutrients can be described, and the dietary pattern can be compared with recommended intakes of nutrients.

Data from different levels can be compared. Fig. 13 and 14 show a comparison of data from FAO food balance sheets and from the Greek household budget survey in 1974 and 1981/1982. Clearly, although the amounts differ, the trends are the same for all commodities. The differences are greatest for vegetables and fruits, the commodities on which FAO finds it most difficult to obtain good information.

Table 6 provides even more detailed information on four different levels: FAO and national food balance sheets, a household budget survey and an individual-level survey of a representative population. The table clearly illustrates the differences between data sources, in this case in Hungary.
Conclusions

The user of food balance sheet data should be aware that FAO and national data are not quite similar, and that the differences are not consistent between nutrients or food commodities. The differences can arise from the level in the food supply chain at which data are collected and the use of different nutrient conversion factors. These inconsistencies hinder comparisons of national food balance sheets, and of FAO and national data.
When available, national data should be used for domestic purposes, such as food and nutrition policy-making. In comparative studies, data from FAO and national sources should not be mixed.

Food balance sheet data naturally show higher figures than data collected further along the food chain. It is important to check, however, that the trends are consistent between the data sets, and that the levels of per caput figures are reasonable and explainable.

For the user who heeds the necessary caveats, food balance sheets are valuable sources of information about trends and levels in food availability.
Fig. 13. Per caput supply of fish and sugar in Greece, according to FAO food balance sheets (FBS) and the Greek household budget survey (HHBS), 1974 and 1981/1982

Source: FAO food balance sheets, 1979–81 average (1) and Trichopoulou (13).
Fig. 14. Per caput supply of fruit, vegetables and potatoes in Greece, according to FAO food balance sheets (FBS) and the Greek household budget survey (HHBS), 1974 and 1981/1982

Source: FAO food balance sheets, 1979–81 average (1) and Trichopoulou (13).
Table 6. Energy and nutrient intake in Hungary in 1985, according to four data sources

<table>
<thead>
<tr>
<th></th>
<th>FAO food balance sheets</th>
<th>National food balance statistics</th>
<th>Household budget survey</th>
<th>National Health and Nutrition Survey data&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td></td>
<td>Males</td>
</tr>
<tr>
<td></td>
<td>19-34</td>
<td>35-60</td>
<td>&gt; 60</td>
<td>19-34</td>
</tr>
<tr>
<td>Energy&lt;sup&gt;b&lt;/sup&gt; (MJ)</td>
<td>14.7</td>
<td>13.6</td>
<td>13.0</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td>3520</td>
<td>3240</td>
<td>3110</td>
<td>2890</td>
</tr>
<tr>
<td>Protein (g/day)</td>
<td>95.0</td>
<td>105.0</td>
<td>101.0</td>
<td>112.8</td>
</tr>
<tr>
<td>Fat (g/day)</td>
<td>140.0</td>
<td>142.0</td>
<td>128.0</td>
<td>135.7</td>
</tr>
<tr>
<td>Carbohydrate (g/day)</td>
<td>406</td>
<td>390</td>
<td>390</td>
<td>285</td>
</tr>
<tr>
<td>Percentage of total energy derived from:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>protein</td>
<td>10.7</td>
<td>13.0</td>
<td>13.0</td>
<td>15.9</td>
</tr>
<tr>
<td>fat</td>
<td>35.7</td>
<td>39.0</td>
<td>37.0</td>
<td>43.6</td>
</tr>
<tr>
<td>carbohydrate&lt;sup&gt;c&lt;/sup&gt;</td>
<td>46.0</td>
<td>48.0</td>
<td>50.0</td>
<td>40.5</td>
</tr>
</tbody>
</table>

<sup>a</sup> By sex and age.

<sup>b</sup> Alcohol excluded.

<sup>c</sup> Alcohol (about 8%) excluded.

References

There are two approaches to finding out if a population has an adequate diet. The first is to measure nutritional status in a sample of the population. The second is to measure food intake in a population sample and estimate the nutritive value of the diet. These two approaches complement one another, but this chapter deals exclusively with the second.

When measurements of food intake have been made, the next problem is how to evaluate them. If, for example, the average protein intake of a group of people is 65 g per caput per day, what conclusions can be drawn about the adequacy of the group’s diet or its likely effects on health? Food intake is usually evaluated by comparison with recommended intakes of nutrients and energy. It is important to remember, however, that dietary intake figures alone can never prove whether people are adequately fed. Intake data can only indicate the level of probability that this is the case.

This chapter is intended to enable the reader to use existing recommendations to evaluate dietary intake. It describes recommended intakes, how they are derived, their limitations and how they can be used.

Definitions

Five terms need to be defined: nutrient requirements, recommended intakes of nutrients, nutrient goals, dietary guidelines and dietary
standards. First, nutrient requirements must be differentiated from recommended intakes.

The requirement for a nutrient is the least amount that is needed to maintain a person in good health. Requirements vary between individuals and even between those of the same age, sex, body size and level of physical activity. The requirements of a group of similar people therefore fall within a certain range.

The recommended intake of a nutrient is the level thought to be sufficiently high to meet the requirements of almost all people in a group with similar characteristics (such as age, sex, body size and level of physical activity). Recommended intakes have been published for vitamins, most minerals, protein and energy. Synonyms for recommended intake are:

- recommended daily allowances,
- recommended daily intakes,
- recommended nutrient intake.

Recommended intakes were originally formulated for the planning of population food supplies. This is why they are set to meet the highest levels of need likely to be found in a population.

The terms nutrient goals and dietary guidelines are used in many different ways. In this chapter, nutrient goals are recommendations for the distribution of energy sources in the diet (that is, the percentage of total energy coming from fat, protein and carbohydrate) and for the intake of sugar, dietary fibre and salt. Dietary guidelines, on the other hand, are recommendations translating nutrient goals into suitable food intakes. They are formulated in a way that makes them understandable and useful for people without nutritional expertise. These recommendations are aimed at the general public. Dietary standards is a common synonym for recommended intakes of nutrients and nutrient goals. Another is nutritional recommendations.

How Requirements and Recommended Nutrient Intakes are Established

Requirements
Requirements may be set at different levels:

- the amount needed to prevent the appearance of clinical symptoms of deficiency;
- the amount needed to maintain body stores of the nutrient at a certain level; or

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— the amount needed to replace inevitable body losses.

There is no standard method for estimating a requirement. For some nutrients, the minimum requirement of adults has been measured by giving deficient diets to volunteers for long periods, until clinical deficiency symptoms appeared, and subsequently determining how much of the nutrient in question was needed to cure these. Requirements may also be determined by metabolic balance studies. Volunteers eat a diet of constant composition for some time while all their excreta are collected and analysed; then differences between input and output are calculated. A third way of estimating requirements consists of carefully measuring body stores of the nutrient and the rate at which those stores are replenished. For ethical reasons, these methods can only be used to a very limited extent on children, pregnant and lactating women and the elderly. Nutrient requirements for these groups may be estimated by extrapolating from the requirements of healthy adults or by other techniques, such as balance studies.

Energy requirements are somewhat differently estimated. They are defined as the average amount of energy that would be expended under varying circumstances. Energy requirements are given not only for different age and sex groups but also for people with different ranges of body weight and levels of activity. The requirements are based on measurements of both intake and expenditure. There is no true minimum requirement for energy.

Recommended nutrient intakes
At present, knowledge is very limited about the variation in nutrient requirements between and within individuals. A large component of variation is therefore included when recommended intakes are set. As countries may use different estimates, the recommended intakes may also differ.

The recommendations are based on an estimated minimum requirement, although the knowledge of this minimum is often very limited. The recommendations may subsequently be derived in one of three ways (Fig. 1):

— the mean requirement for the group plus two standard deviations;

— the mean requirement for the group plus a fixed percentage increment;

— an arbitrarily defined “typical intake”, often based on dietary surveys.
First, some recommended nutrient intakes include what is called the safe level — the mean minimum requirement plus two standard deviations. FAO, WHO and the United Nations University (UNU) used this method to define the protein needs of adults (1). Such a recommendation is based on a considerable knowledge of the requirement, as both the mean and the distribution are known.

Second, a recommendation may be derived from the mean requirement for the group plus a fixed percentage increment. In this case, knowledge is much more limited, as only the mean requirement is known. For example, FAO and WHO have set the recommended daily amount of thiamine at 20% above the estimated mean requirement levels (2). Canada has set the recommended daily intake of vitamin B₁₂ at 100% above that needed to prevent the appearance of clinical manifestations of deficiency, to allow for variations in absorption and other factors, including the maintenance of moderate body stores (3). The recommended daily intake of folacin in the United States is set 300% higher than the estimated requirement for free folic acid, to allow for the decreased availability of the derivatives of folic acid (4).

Third, a recommendation may be based on an arbitrarily defined typical intake, often based on dietary surveys. In this case, the requirement is not known but a level — called the typical intake —
has been determined at which no deficiency signs are seen. In the United States, a chromium intake of 50–200 µg/day is tentatively recommended for adults. No requirement is known, and this range is based on the absence of signs of chromium deficiency in the major part of the population of the United States, who consume an average of 60 µg of chromium per day. The safety of an intake of 200 µg was established in long-term supplementation trials in human beings (4). In the United Kingdom, protein recommendations were set at 10% of total dietary energy on the grounds that this was the habitual intake of the population (5).

Nutrient goals
Nutrient goals are not based on the principle of minimum requirements. Essentially, they emanate from a consensus on the connection between food intake and health, and are often based on epidemiological studies relating diet and disease patterns (for cardiovascular diseases and cancer, for example). The goals may be designed to secure a maximum rather than minimum intake of a nutrient. Thus, a nutrient goal for fat may be a maximum of 35% of total energy, which would be a reduction in intake for many people. It may also state, however, that 10% of the fat should be polyunsaturated, an increase for most people. A nutrient goal is thus based on an assumption about a suitable average population intake.

For example, the Canadian Government set a fat contribution of 35% to dietary energy as a goal for the national diet (6). The National Advisory Committee on Nutrition Education set a goal of 30 g of dietary fibre per day for the United Kingdom (7). The recent Nordic nutrient goals recommend the following energy distribution (8):

- a maximum of 30% from fat,
- 10–15% from protein,
- 55–60% from carbohydrate, but a maximum of 10% of energy from refined sugar.

Evaluation of Dietary Intake
Recommended intakes of nutrients were originally established for planning purposes. Thus, they exceed the requirements of almost all the individuals in a population. This is important to remember when these intakes are used for a completely different purpose: evaluating the sufficiency of dietary intakes. There is usually no problem in evaluating nutrient intakes that are well above recommended levels. The problem arises in interpreting intakes below these levels.
The main reason for using nutrient recommendations to evaluate diets may simply be that no other official standards exist. A few countries have tackled this problem by publishing two sets of values: a recommended nutrient intake and a minimum intake specially constructed for evaluation. In the Nordic recommendations (8), the description of the lower limits for intake of nutrients includes this statement: “If the intakes fall below this limit for a longer period of time, deficiency diseases may appear.” New Zealand has also established minimum safe intakes (9). Until now, such intakes were set for a limited number of nutrients by only a few countries.

Minimum intake figures are based on minimum requirements, but the extent of their similarity to the requirements is not always clear.

For the majority of countries, however, minimum intakes are not clearly stated in any official publication. Minimum requirements may be given in the background documents for tables of recommended intakes, or found in the publications of United Nations specialized agencies or the scientific literature. Surprisingly, when evaluating dietary intakes, many professional nutritionists prefer to use nutrient recommendations and goals (which are defined at national level and vary between countries) instead of minimum requirements.

This means that values for recommended intakes are used to evaluate dietary intakes in most countries, although the minimum requirements would be preferable, as they are more precisely defined. Great caution must be exercised in the use of recommended intakes, in both application (the type of dietary intake data they are intended to evaluate) and analysis (how they are used). The following sections discuss the use of nutrient recommendations or goals in relation to three main types of dietary intake data.

Food balance sheets: a warning

Food balance sheets, properly speaking, describe, not dietary intake, but the gross amounts of food moving into consumption in an entire country over a year (see Chapter 4). The data cannot therefore be used as a basis for the evaluation of the adequacy of energy or nutrient intakes in the country by comparison with requirements or recommended intakes.

Food balance sheets can, however, serve other purposes, such as surveying developments in food supply in the country as a whole. This may indicate what progress is being made towards achieving national nutrient goals and following dietary guidelines. When the data are used for monitoring, however, it must always be remembered that nothing is said about the population groups affected by the changes. The evaluation of policy progress is thus a limited one.
Household budget surveys
A survey in which the household is the unit of measurement (see Chapter 5) cannot be used to evaluate the diets of individuals or different groups, since nothing is known about the distribution of food within the household. It cannot, for example, be assumed that food is distributed according to household members' physiological needs. Indeed, some studies indicate that the reverse may at times be true (10).

Nevertheless, the methods of measurement used in household surveys yield data of sufficient precision for some comment to be made on the composition of the diet available to the household. This can be compared with national nutrient goals and dietary guidelines. For example, the fat or fibre content of the diet can be compared with goals when these are expressed in relative terms. Again, however, only limited conclusions can be drawn.

When the intake of a group of people or households is compared with a dietary standard or nutritional requirement, three situations may apply. As shown in Fig. 2, the nutrient intakes of the group may be below the dietary standard (situation A), distributed around it (situation B) or above it (situation C). Situation B is the most common and the most difficult to interpret.

Surveys of individuals
Proper use can be made of dietary standards in surveys with the individual as the basic unit of measurement (see Chapter 6), as groups can be defined according to age, sex and other characteristics, and the problem of the distribution of intakes does not arise. When recommended intakes are used to evaluate the intake of individuals, it must be remembered that the recommended intake exceeds the actual requirement of almost all individuals. Thus, an individual intake of a nutrient below the recommended level means only that a person may be inadequately nourished, although the probability grows the further the observed intake falls.

Fig. 3 shows the assessments that can be made about the adequacy of grouped individual intakes. If the mean minimum requirement of a nutrient is known, it is possible to estimate the overall probability that the average intake of this nutrient by a group is adequate. If the standard deviation of the requirement is also known, an estimate can be made of the prevalence of adequate (or inadequate) intakes. The method is described in detail in the appendix to this chapter.

If only a recommended intake of the nutrient is known, the next step depends on how this was derived. If the recommended intake is set as the minimum requirement plus two standard deviations or a
Fig. 2. Comparison of dietary intakes with a dietary standard

Dietary standard

Fig. 3. Flow chart of the evaluation of a mean nutrient intake from a survey of individuals

Mean intake + sd is known

Is the minimum requirement known?

No evaluation possible except comparison with other survey results

Is an RDA known?

Is the relation of RDA to MR known?

RDA is set arbitrarily

Compare RDA with mean intake + 2 sd

Use or calculate minimum requirement using procedure in Appendix

RDA = recommended intake
sd = standard deviation

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given percentage, the average minimum requirement is very likely to be available in the text of the recommended intake document.

If the recommended intake has been arbitrarily defined or if its derivation is unknown, only a limited range of definite pronouncements can be made about the adequacy of intake of this nutrient. First, it can be determined whether a mean intake falls below the standard. Second, an upper level of intake (mean intake plus two standard deviations, or the ninetieth percentile) can be compared with the intake of the lowest 10% or 25% of the population reaching the recommended level. The only comment that can be made on this basis is that the further the intake is below or above the recommended level, the more likely it is to be inadequate. The possibility of further comments depends on what is known about the nutrient in question.

In this situation, it may be useful to go back to the recommended intake background document, to find out the assumptions on which the recommended value is based. These assumptions may then be judged in the context of the diet in the country in question.

Using an arbitrary fixed limit (say 50% or 70% of the recommended intake) as a criterion for inadequate intake is not advisable, as there is usually no justification for such a limit. Instead, inadequacy should be seen in terms of a probability scale. This can be done even when information is insufficient actually to calculate probabilities.

Today, the average minimum requirement and the variance of the requirement are known for only a few nutrients. The probability approach can be used in its proper sense only for these (12), although the approach can be used for several other nutrients on a less solid basis.

The question arises as to where a substantial probability of inadequacy begins. The answer depends on both the size of the variation of the requirement and the magnitude of the safety margin used when the recommendation was set. The following example demonstrates some probability values. Take a nutrient for which the requirement is known and normally distributed, with a coefficient of variation of 15% and recommended intake set at two standard deviations above the mean requirement. An intake equal to the recommended figure would have a 2% probability of being inadequate for

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"The following are the nutrients for which FAO/WHO publications quote a minimum adult requirement as well as stating a recommended daily amount: protein (1), calcium (11), and vitamin A, thiamine, riboflavin, niacin and vitamin C (1,2). These figures should be used with care, since the minimum requirements are sometimes only briefly mentioned, and what is described as a table of requirements is often a table of recommended dietary allowances."
an individual. At an intake equal to the mean requirement, this probability would be 50%. At one standard deviation below the mean requirement, the probability would be 84%.

In the case of energy, it must always be remembered that the recommended intake is an average requirement. Even after adjustment for body size, level of activity and other variable characteristics, it must be recognized that the individual's real requirement has an equal chance of being above or below the estimated intake. This should be remembered in both counselling and assessment.

If nutrient goals are being used to evaluate surveys of individuals, the situation is much the same as that for arbitrarily defined recommended intakes. A goal is usually a single figure, which may be defined as a safe upper or lower limit for group average intakes. If the whole range of a group's intakes is above or below the goal, it can be confidently stated that the goal has or has not been met. In cases of overlap, the mean intake can be quoted alongside the goal, but no estimates can be made of numbers of people likely to be at risk, owing to the absence of a variance attached to the goal. For further discussion of individual dietary surveys, see Cameron & van Staveren (13).

Conclusions

Distinctions should be made between requirements, recommended intakes, nutrient goals, and dietary guidelines, as they are derived in different ways.

Food balance sheets cannot be used to evaluate the adequacy of the diet, but only for judging whether the various components of the diet of the whole nation are moving towards nutrient goals and dietary guidelines over a long period of time. Household surveys can be used only to judge the composition of the diet per energy unit in comparison with nutritional recommendations.

Individual surveys can be used for evaluating the adequacy of dietary intake. Using recommended intakes for this purpose is difficult as they were originally constructed for planning purposes. If the minimum requirements for nutrients and the variance of the requirements are known, however, a probability approach can be used to evaluate each nutrient.

References

Appendix

Probability approach calculations

The Method

Student's $t$-test can be used to calculate the probability that a sample of size $N$, with mean intake $I$ and standard deviation $S$, was drawn from a population with a mean requirement $R$ ($I$):

$$ t = \frac{R - I}{S/\sqrt{N}} $$

The probability that the group's intake is adequate increases with decreasing values of $I$, and vice versa. If $I$ differs from $R$ by more than $3 \times S$, it is almost certain that the group's intake is adequate (or inadequate, depending on the sign of the difference). This method cannot, however, estimate the number of people in the group who may be at risk of dietary inadequacy.

If, in addition to the mean value, $R$, the standard deviation $D$ of the requirement is known, an estimate can be made of the number (or proportion) of people in the group whose intake is less than they require. This calculation cannot identify individuals at risk; it can only produce an estimated prevalence. Assuming that requirements are normally distributed, the midpoints of $1D$ intervals in the distribution can be used to estimate the probability of adequate or inadequate intake (Table 1). Multiplying the probabilities given in the final column by the number of intakes recorded in the appropriate intervals gives an estimate of the number of inadequate intakes within each interval. The sum of these estimates is an estimated prevalence for the whole group.

Examples of both types of calculation are given below.
Table 1. Estimates of the probability that the intake of individuals within a group is adequate or inadequate

<table>
<thead>
<tr>
<th>Interval</th>
<th>Midpoint</th>
<th>Probability that intakes within this interval are:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>adequate</td>
</tr>
<tr>
<td>&lt; R - 3.5D</td>
<td>—</td>
<td>0</td>
</tr>
<tr>
<td>R - 3.5D to R - 2.5D</td>
<td>R - 3D</td>
<td>0.0013</td>
</tr>
<tr>
<td>R - 2.5D to R - 1.5D</td>
<td>R - 2D</td>
<td>0.0227</td>
</tr>
<tr>
<td>R - 1.5D to R - 0.5D</td>
<td>R - D</td>
<td>0.1590</td>
</tr>
<tr>
<td>R - 0.5D to R + 0.5D</td>
<td>R</td>
<td>0.5000</td>
</tr>
<tr>
<td>R + 0.5D to R + 1.5D</td>
<td>R + D</td>
<td>0.8410</td>
</tr>
<tr>
<td>R + 1.5D to R + 2.5D</td>
<td>R + 2D</td>
<td>0.9772</td>
</tr>
<tr>
<td>R + 2.5D to R + 3.5D</td>
<td>R + 3D</td>
<td>0.9987</td>
</tr>
<tr>
<td>&gt; R + 3.5D</td>
<td>—</td>
<td>1</td>
</tr>
</tbody>
</table>

Examples

In example 1, a minimum requirement is known, but not the standard deviation. The mean minimum requirement (MR) for thiamine is 0.33 μg/kcal-d (I). A group of 25 young men have a mean intake of 0.40 ± 0.10 μg/kcal-d. What is the probability that this mean intake describes a group with adequate thiamine intakes?

\[ t = \frac{MR - I}{S/\sqrt{N}} \]

\[ = \frac{0.33 - 0.40}{0.10/\sqrt{25}} \]

\[ = -0.07 \times 5 \]

\[ = -3.5 \]
Statistical tables show that the (one-tailed) probability associated with this value of \( t \) is 0.0025 – 0.0005, or less than 1%. Thus, the probability is almost negligible that the average intake of the group is inadequate. The intakes are thus concluded to be adequate. An estimated prevalence of inadequate intakes, however, cannot be calculated.

In example 2, a minimum requirement and its standard deviation are known. The mean and frequency distribution of iron intakes of a group of 50 non-pregnant, non-lactating women of childbearing age are shown in Table 2. The women obtain more than 25% of their dietary energy from proteins of animal origin. The mean requirement for iron in this group is 14 mg/d, with a coefficient of variation of 25% (2). Thus, \( MR = 14 \pm 3.5 \) mg/d. The mean intake of the group is 12.5 mg/d.

Using the distribution of intakes and probability calculations as shown in Table 1 results in the calculations of the prevalence of inadequate iron intakes shown in Table 2.

Table 2. Calculations of the prevalence of inadequate iron intakes in members of a group of 50 non-pregnant, non-lactating women of childbearing age

<table>
<thead>
<tr>
<th>Interval (mg/d)</th>
<th>Midpoint (mg/d)</th>
<th>Number of women (Col. 1)</th>
<th>Probability of Inadequate Intakes In this Interval(^a) (Col. 2)</th>
<th>Calculated prevalence of Inadequate Intakes In this Interval (Col. 1 x Col. 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5.25</td>
<td>---</td>
<td>0</td>
<td>0.9987</td>
<td>0</td>
</tr>
<tr>
<td>5.25 – 8.75</td>
<td>7.0</td>
<td>2</td>
<td>0.9772</td>
<td>1.95</td>
</tr>
<tr>
<td>8.75 – 12.25</td>
<td>10.5</td>
<td>15</td>
<td>0.8410</td>
<td>12.62</td>
</tr>
<tr>
<td>12.25 – 15.75</td>
<td>14.0</td>
<td>30</td>
<td>0.5000</td>
<td>15.00</td>
</tr>
<tr>
<td>15.75 – 19.25</td>
<td>17.5</td>
<td>2</td>
<td>0.1590</td>
<td>0.32</td>
</tr>
<tr>
<td>19.25 – 22.75</td>
<td>21.0</td>
<td>1</td>
<td>0.0227</td>
<td>0.02</td>
</tr>
<tr>
<td>&gt; 22.75</td>
<td>---</td>
<td>0</td>
<td>0.0013</td>
<td>0</td>
</tr>
</tbody>
</table>

Total 50 29.91 \( \equiv 30 \)

\(^a\) Obtained from Table 1.
The first method presented could be used to determine the probability that the mean intake of the whole group is inadequate. According to statistical tables, this probability is 0.983 and corresponds to $t$, when:

$$t = \frac{14 - 12.5}{3.5/\sqrt{50}}$$

Thus, 30 out of the 50 women may have inadequate iron intakes (although they cannot be identified individually), and there is a high probability (98%) that the intake of the group is not sufficient.

In example 3, a recommended daily allowance (RDA) is given and its relationship to the minimum requirement (MR) is stated. In such a case, the simplest course is to calculate back to the MR. For example,

- if $\text{RDA} = \text{MR} + 30\%$, then $\text{MR} = \text{RDA}/1.3$.

If the RDA is stated to be a safe level, then it is equal to $\text{MR} + 2$ standard deviations. When the standard deviation is not known, it may be assumed, for many nutrients, that the coefficient of variation of the requirements is 20%. Thus,

- if $\text{RDA} = \text{MR} + (2 \times 20\%)$, then $\text{MR} = \text{RDA}/1.4$.

When a recommended intake is given and its relation to any minimum requirement is unknown, probability calculations are not meaningful.

References

Annex 1

Analysis of the sugar flow in Norway

K. Lund-Larsen & A.H. Rimestad

In Norway, quantitative dietary data are registered on three different levels:

- national food supply
- food purchased by private households
- intake by individuals.

To illustrate the differences in amounts of a specific food registered on the three levels and explain to some extent how these differences come about, the authors follow sugar along the food chain, from import to final consumption.

In this context, sugar is defined as the total sugar (sucrose) content of the diet as it is registered on the different levels, including refined sugar and sugar contained in products. Available sugar is defined as imports minus exports minus the amounts used for non-food industry and fodder plus or minus the amounts in stock. This corresponds to the food supply level.

Sources of Data

The sources of the data used include food balance sheets, the household budget survey run by the Central Bureau of Statistics (CSB) and dietary surveys carried out by the Section for Dietary Research at the University of Oslo. In addition, the authors collected information on the production and turnover of foods from food producers, sales organizations and other relevant bodies.

Data on imports and exports are given in the annual statistics on foreign trade, issued by CSB (1,2). As no sugar is produced in
Norway, all available refined sugar is imported. In addition, some sugar is imported in sugar-containing products. To be able to estimate this amount, each imported food or food group, represented by a numerical code in the statistics, had to be identified, and the sugar content was estimated according to the Norwegian food composition tables (3).

CSB collects statistics on the purchase of refined sugar by the food industry (4,5). The data were checked with information obtained from the companies concerned on their production volume and share of the market. Refined sugar is also used in other industries and as fodder. CSB gives information on these uses (4,5) and provides data on stocks four times per year (6,7). In addition, refined sugar for retail distribution is defined as refined sugar not used in industry, as fodder or as stocks. The amount is estimated as a remainder.

The household budget survey carried out each year by CSB gives data on the amounts of food, including refined sugar and sugar-containing foods, purchased by a representative sample of private households in two-week periods spread over the year. The sugar content of the purchased food is calculated according to the standards of the nutritional database of the Section for Dietary Research.

Dietary surveys carried out by the Section for Dietary Research provide data on intake by groups of individuals. These data are representative only of the groups surveyed, not the whole population. Data on this level are given here only to indicate the magnitude of the differences between the purchase and intake of food.

**Results**

As the amount of sugar imported varies from year to year according to factors that include price, the mean of data for two consecutive years was used as the basis for the authors’ survey. 1979 and 1980 were chosen because the data sets for these years were relatively complete. In addition, the sugar prices in Norway and Sweden were comparable in that period. This indicates that there was little trade of sugar across the border. Such trade could bias the data on imports and exports, depending on the country profiting from the price difference.

The movement of sugar from import to intake is shown in Fig. 1. The figures for the amounts of imported sugar, available sugar, household purchases and individual intake are averages of those for 1979 and 1980. The average amount imported was about 180 million kg. If the waste that inevitably occurs during the process of production, transportation and storage is ignored, a mean of about 175 million kg of sugar was available for human consumption in each
year (43 kg per caput per year). When this amount was compared with the amount of sugar purchased by private households in the same period (30 kg per caput per year) there was a discrepancy of 13 kg. What can explain this discrepancy?

Further, in two dietary surveys (using the 24-hour recall method and performed before and after the period covered in the survey), the mean intake of sugar was estimated at an equivalent of 11–18 kg per caput per year (8,9). Individual intakes of sugar vary widely. As mentioned, data on individual intake are not representative for the whole country. In addition, the mean intake of sugar in groups of
individuals registered in dietary surveys is in general lower than that registered in household budget surveys. In the present survey, individual intake was tentatively set at 16–20 kg per year.

Reliability of the Data

Part of the explanation of the discrepancy between available sugar and purchases by households may lie in the reliability of the data.

Available sugar

The data on available sugar came from different sources and were not collected for this survey. Certain recalculations and approximations of the basic statistics were necessary, particularly in the estimation of the sugar content of imported and exported foods. On the whole, these estimates are conservative. These inaccuracies, however, cancel each other to some extent. All the data sources were checked against others, and the agreement between the different sets was satisfactory. On the whole, a reasonably good estimate is given of the order of magnitude of the different components of the available sugar.

Purchases by households

The sample of private households in the household budget survey is intended to be representative of the country. Unfortunately the non-response rate is relatively high: 30–40%. It is highest in large cities and single-person households (10). These are the areas and, to some extent, the households for which the surveys for the period 1977–1979 show lower purchases (11). Households with the highest purchases may thus be overrepresented in the sample.

The surveys include all foods brought into the household, whether purchased, produced by the household, or acquired as a gift or in some other way. Foods bought and consumed outside the household, however, are not registered by amount, but only as unspecified expenditure. It is not known whether the proportion of sugar or sugar-containing products in this second group of foods is larger or smaller than in recorded purchases. Nevertheless, this practice leads to an underestimation of purchased amounts.

Although the recording periods are spread over the year to cover seasonal variations, purchases made during long vacations are not included, although the diet on such occasions often differs from the usual. The extent to which this influences the data can only be guessed at, but may lead to a further underestimation of purchased sugar.

In addition, the data describe the purchase of sugar in private households. About 10% of the Norwegian population is presumed to
be catered for by institutions and catering businesses (12). Except for one dietary survey of a military camp, the authors had no data about the use of sugar in large-scale households. Nevertheless, these households are relatively few. To contribute significantly to the explanation of the discrepancy in amounts, the two types of household must differ greatly in the use of sugar. So far, no data indicate that this is the case.

In summary, several factors may influence the data on the purchases of sugar in the household budget surveys. Some of the factors may balance each other but, on the whole, the authors think that the estimate of purchases is somewhat low, and consequently that the estimate of the discrepancy must be somewhat high.

Other Explanations

Private production of alcohol
The private production of alcohol is often used to explain the discrepancy in amounts of sugar between the food supply and household levels. Table 1 compares the amounts of available sugar and household purchases. The difference in refined sugar appears to be about 3 kg per caput per year. Estimates suggest that private production accounts for about 8 million kg (about 2 kg per caput) of refined sugar each year.

As the private production of spirits is illegal in Norway, it is assumed that sugar purchased for this purpose may not be recorded. Although it is obviously impossible to get exact data on how much refined sugar is actually used for the purpose, private alcohol production explains only part of the discrepancy.

Wastage
As previously pointed out, waste is inevitable when foods are produced, traded or stored. Very little is known about its magnitude. In the absence of reliable data, the differences in the energy content of the diet as recorded on the different levels are used to approximate wastage. From Table 1 it appears that the energy content is reduced by approximately 2 MJ per caput per day, which implies a maximum wastage of about 20%.

Corrections are made in Table 1 for the differences in energy content on the two levels. As the amounts of refined sugar are practically the same on both, the wastage of refined sugar appears to

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* Brun Gulbrandsen, B. National Institute of Alcohol Research (personal communication).
equal the mean wastage of all the foods contributing to the food supply. In addition, the amount of sugar from purchased products appears to be lower than would be expected if the wastage of these products were of the same magnitude as the mean wastage for all foods. One explanation could be that the wastage is higher for these products than other foods. This seems unlikely, however, as sugar is very stable chemically, does not spoil and is widely used as a preservative. The sugar-containing products contributing most to the total amount of sugar (preserves, chocolate and soft drinks) are also produced and packed with an eye to preservability. Several undertakings estimated the wastage of sugar in several food-producing plants to be 0-4%.

The wastage of sugar-containing products is very unlikely to be higher than that of other foods. Wastage is therefore another partial explanation of the sugar discrepancy.

**Unregistered purchases and storage**

Some explanations have been given, but Table 1 may indicate two others.

The greatest loss of sugar is found in sugar-containing products, particularly chocolate, soft drinks and preserves. Chocolate and soft drinks are usually consumed between meals and are easy to obtain. Sales statistics show that about 50% of chocolate was sold through kiosks, petrol stations and similar outlets, while about 30% of soft drinks were sold through kiosks, cafés, restaurants and hotels. Assuming that the amount lost is of the same magnitude as the reduction in energy content, the remaining difference in sugar from chocolate equals that contained in a medium-size (60-g) bar of chocolate per caput per week. The difference in sugar from soft drinks equals that contained in a small bottle (0.35 litre) per caput per week. Unregistered purchases of this magnitude are possible and probable.

Unregistered purchase is not a likely explanation for the difference in the amounts of sugar from preserves (fruit and berries in jam or as a canned product), as these foods are primarily eaten at home. Preserves, however, can easily be stored for long periods. Changes in stocks are therefore a more likely explanation of the discrepancy between the two levels.

**Conclusion**

The results of this survey imply that the difference in the amounts of sugar recorded at the food supply and household levels can be explained as the sum of several factors. Fig. 2 estimates their impact.
Table 1. Comparison of data on available sugar (on food supply level) and purchased sugar (on household level)

<table>
<thead>
<tr>
<th>Form</th>
<th>Available sugar</th>
<th>Purchased sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg/caput/year</td>
<td>g/MJ</td>
</tr>
<tr>
<td>Refined sugar</td>
<td>21.4</td>
<td>4.7</td>
</tr>
<tr>
<td>Sugar in products:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>— preserves</td>
<td>7.5</td>
<td>1.6</td>
</tr>
<tr>
<td>— chocolate</td>
<td>5.2</td>
<td>1.2</td>
</tr>
<tr>
<td>— soft drinks</td>
<td>5.2</td>
<td>1.2</td>
</tr>
<tr>
<td>— bakery products</td>
<td>2.0</td>
<td>0.4</td>
</tr>
<tr>
<td>— dairy products</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>— others</td>
<td>0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>— total sugar in products</td>
<td>21.5</td>
<td>4.7</td>
</tr>
<tr>
<td>Total</td>
<td>42.9</td>
<td>9.4</td>
</tr>
<tr>
<td>Energy (MJ/caput/day)</td>
<td>12.5</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2. Contributions of various factors to the discrepancies between the amounts of sugar recorded at the food supply and household levels

<table>
<thead>
<tr>
<th>Amount (kg per caput per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined sugar</td>
</tr>
<tr>
<td>Sugar contained in:</td>
</tr>
<tr>
<td>preserves</td>
</tr>
<tr>
<td>chocolate</td>
</tr>
<tr>
<td>soft drinks</td>
</tr>
<tr>
<td>bakery products</td>
</tr>
</tbody>
</table>

- Private production of alcohol
- Storage
- Unregistered purchase
- Wastage
The divisions between wastage and other factors are somewhat arbitrary. Wastage may account for as much as 40% of the difference; unregistered purchase, 30% or more; sugar in stored preserves, as much as 15%; and private production of alcohol, at least 10%.

This survey may be regarded as an example of the complementary use of different sources of data to throw light on dietary aspects not necessarily illuminated by ordinary dietary surveys and food statistics. The survey also reveals the difficulties encountered in trying to explain differences between data sets. In a scientific context, relying so heavily on educated guesswork is rather unsatisfactory. The interest shown by policy-makers, however, seems to show that the survey has provided useful results.

References


Proposed system for food and nutrition surveillance in Norway

A.Ø. Sørheim, G. Botten, L. Johansson & S. Larsen

The committee for the research programme on instruments of nutrition policy, administered by the Norwegian Research Council for Applied Social Sciences (NORAS), has issued two reports on the possibilities of establishing a system of food and nutrition surveillance in Norway (1,2). At a 1988 seminar arranged by the programme committee, representatives of research groups and the authorities discussed the interest in and feasibility of establishing such a system (3).

This is an attempt to clarify the organization, working methods and costs of a food and nutrition surveillance system, and to encourage the people who might run or use it to state precisely how it can best serve their needs and interests.

Purposes

Preliminary discussions with research groups and representatives of the authorities seem to show general agreement that an effort should be made to establish a simple system of surveillance of food and nutrition in Norway. A surveillance system means an organized administrative system to systematize, interpret, evaluate and communicate data.

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a Permission to use this text has been granted by the Norwegian Research Council for Applied Social Sciences.
The main purpose of the surveillance would be to assess the need for measures to promote the nutrition and health policies adopted in Norway. The relevant data would be those on the occurrence of diseases and the risks of disease connected to diet and the food supply. The system would not monitor individual people.

The system could suitably include data on diseases and risks, on diet and on food. At present these data are collected by various agencies and different methods, with little coordination. The system should facilitate the combination of different sets of data, and present them in a more suitable and understandable form to both the administrators of nutrition policy and research groups. In principle, the expertise and procedures of the agencies who now collect, analyse and present their own data must be used to establish the system, which should take due account of their interests.

The system must be organized to serve the needs of decision-makers and of those responsible for implementing nutrition policy at both local and central levels. The system should monitor and evaluate the occurrence of recognized problems, and quickly register new ones. It should also have a signalling or warning function. It is not intended to monitor nutrition policy, or to chart or assess the effects of measures taken to implement policy.

Finally, the system must be capable of answering questions, such as those from a municipal health service, on any health risks connected to the food supply and diet of the inhabitants of a municipality or larger geographical area.

Organization

The surveillance system can be appropriately described as consisting of two related parts: a system of data suppliers and a system of data coordinators. The suppliers of the data would not only collect and present data in a suitable manner, but often also process and analyse them, although not in the context of the overall surveillance for which the system is intended. In the same way, the coordinators would do more than merely coordinate collected data.

Any system that is established should be simple, both to administer and as regards the quantity of data. It is probably better to begin with moderate ambitions and, if necessary, gradually extend the system to include a larger number of indicators. The system is not intended to conduct research, but to receive and apply research results. Fig. 1 presents the organization of the food and nutrition surveillance system proposed for Norway.
Fig. 1. Organization of a food and nutrition surveillance system proposed for Norway

<table>
<thead>
<tr>
<th>Types of data</th>
<th>Suppliers</th>
<th>Data coordination system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data on diseases and risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality data</td>
<td>Central Bureau of Statistics</td>
<td>Coordinator of data on diseases and risks</td>
</tr>
<tr>
<td>Morbidity data for cancer</td>
<td>Cancer registry</td>
<td></td>
</tr>
<tr>
<td>Foodborne infections</td>
<td>National Institute for Public Health</td>
<td></td>
</tr>
<tr>
<td>Blood cholesterol levels in young recruits</td>
<td>Military Classification Board</td>
<td></td>
</tr>
<tr>
<td>Height and weight of women aged 55 years</td>
<td>SHUS (local study)</td>
<td></td>
</tr>
<tr>
<td>Nursing mothers</td>
<td>SYSBARN (local study)</td>
<td></td>
</tr>
<tr>
<td>Data on diet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer data</td>
<td>Central Bureau of Statistics</td>
<td>Coordinator of data on diet</td>
</tr>
<tr>
<td>Food basket</td>
<td>National Institute for Consumer Research</td>
<td></td>
</tr>
<tr>
<td>Diet surveys</td>
<td>Section for Dietary Research, University of Oslo</td>
<td></td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>National Institute for Alcohol Research</td>
<td></td>
</tr>
<tr>
<td>Data on food</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food supply</td>
<td>Budget Board, Norwegian Institute for Agriculture Research</td>
<td>Coordinator of data on food</td>
</tr>
<tr>
<td>Nutrients</td>
<td>Central Bureau of Statistics</td>
<td></td>
</tr>
<tr>
<td>Foreign substances</td>
<td>Section for Dietary Research, University of Oslo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Norwegian Food Control Authority</td>
<td></td>
</tr>
</tbody>
</table>
Data supply system
Data on diseases and risks, on diet and on food are produced by many groups or institutions (the data suppliers). Each type should be grouped in a supply system with a coordinator. The surveillance system should consider the three data supply systems in an integrated manner, and exploit the professional resources that they represent.

Data coordination system
The coordination system has two tasks. First, a coordinating function should be incorporated into each supply system, to ensure that data from different sources are comparable and of high quality. The system should continually supply up-to-date data, which imposes the extra requirement of using methods that have been shown to be reasonably valid. For example, the coordinators must make sure that changes in methods and data collection systems do not make it more difficult to compare the data from one year to the next.

Second, the three coordinators must be jointly responsible for ensuring information exchanges between the three supply systems. The coordinators must also see that information is communicated to decision-makers and that the data in the surveillance system can be used to give a reasonable description of food and nutrition in Norway. Finally, the results of the surveillance must be passed on to both decision-makers and data suppliers.

The Coordinators

Functions
The coordinators should have four functions: systematizing, interpreting, evaluating and communicating data.

Systematization
It is assumed that data are best collected by the agencies with competence in the area concerned. The function of the coordinators is thus to enable people to use the data supplied through systematization.

It may be found that data that could be valuable indicators in the system are not collected. The coordinator should promote the collection of such data or request established suppliers to perform the task. New collection procedures must be assessed very carefully. The groups best equipped to collect the data must be determined, and the cost of collecting the data should be weighed against the benefit obtained.
Interpretation
The coordinators must be able to deal with the data from each and all of the three systems of suppliers. The people responsible for collecting the data would be the first to interpret them. The coordinator should not assess the suppliers' interpretations, but prepare interpretations based on a selection of data from sets from several suppliers.

Evaluation
The task of evaluation should have two parts. The surveillance system must evaluate the quality and relevance of the data collected, and what all the data reveal about food and nutrition in Norway.

Communication
First, information from the system must be given to political decision-makers and the appropriate government agencies. This information must not take the form of a mass of complicated statistics that are difficult to understand and to apply. The justification for and continued existence of the system would depend entirely on the benefit derived by its users.

Second, information on the users' needs must be communicated to the suppliers. This applies to proposals for improving the data and establishing new sources.

Third, the data suppliers must be informed about each others' wishes and demands. These suppliers include administrative units for different sectors (such as health, agriculture and industry) and research institutions in different fields (such as medicine and the natural and social sciences). The surveillance system must promote intersectoral cooperation on nutrition policy, within government agencies and between research groups.

Competence and location
The coordinators must possess competence in one of the areas covered by the supply systems. In addition, they should have some administrative or economic competence.

Each coordinator should be placed in an appropriate government agency. For example, the coordinator for data on diseases and risks could be placed at the Directorate of Health or the National Institute for Public Health, the coordinator for data on diet at the National Nutrition Council, and the coordinator for data on food at the Norwegian Food Control Authority. This would allow close cooperation with as many as possible of the users of information. In addition, the coordinators may be able to use the administrative apparatus to instruct the suppliers of the data to some extent, although the primary intention is to encourage suppliers to participate voluntarily in the surveillance system.
Overall Coordination

Consideration must be given to the coordination of the system as a whole, to ensure that the three coordinators work together. Although it is too early to decide how this cooperation should be achieved, the three coordinators should be made jointly responsible for a product, such as an annual or biannual report on food and nutrition in Norway.

The responsibility for overall coordination of the surveillance system should be placed with a single agency, one of those hosting the coordinators. This task may well be appropriate for the health authorities, as the system is intended to promote the health of the population.

Costs

It is difficult to estimate what the system will cost. In principle, the costs are of two kinds.

First, the costs of coordination would include wages and operating costs for the people who are to coordinate the supply systems, as well as the costs of communicating the information generated by the system. The size of such costs is uncertain, but can be tentatively estimated as comprising the cost of one to three person-years, plus some operating expenses. Certain changes in priorities could allow these costs to be met within the budget and personnel frameworks of the relevant agencies. This option should be considered.

The second type is the cost of collecting and systematizing data on a routine basis or for a particular project. The coordinators would have to purchase data from the suppliers. Sometimes suppliers are paid for data by other sources (such as ministries or directorates), in connection with their administrative functions. At other times, surveys or data collections are made especially for the surveillance system.

A system must be established to finance the collection of data for the surveillance system. It could be based, for example, on contributions from the ministries responsible for health, nutrition, and consumer and research policies. Proper funding must be ensured, so that all relevant data are incorporated into the system, and there is no risk of the funding partners losing interest in the system.

The suppliers of the data and the ministries and any other users of the data must negotiate and agree on the details of the funding system. In this connection, no standpoint has been taken on the question of data ownership or publication rights.
References

1. Østgård, L. & Oshaug, A. Fortløpende vurdering av ernæringssituasjonen, perspektiver for utvikling av et system for dette i Norge [Continual nutrition surveillance, perspectives for developing such a system in Norway]. Oslo, Institute for Nutrition Research, University of Oslo, 1987.


Annex 3

Grouping foods: uses of FAO food balance sheet database

Nutritionists usually categorize foods in groups. FAO presents 15 main groups of food commodities (1):

1. cereals
2. roots and tubers
3. sugars and honey
4. pulses
5. nuts and oilseeds
6. vegetables
7. fruits
8. meat and offals
9. eggs
10. fish and seafood
11. milk
12. oils and fats
13. spices
14. stimulants
15. alcoholic beverages.

These groups broadly correspond with those commonly used by nutritionists.

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This annex is based on the report on a WHO workshop, held in April 1989 in Heidelberg, to explore the possibilities of using the FAO database on food commodities and to make recommendations on the most useful grouping of foods for use in nutrition research and applied nutrition work. Later comments from FAO are also included.
Each group includes a set of relatively homogeneous commodities. Countries may present data on these to FAO at the primary level or at the first, second or even third level of processing. To categorize the data received, FAO initially enters them into a database at the level at which they are reported, and then converts them to primary unprocessed commodities. This allows the coherent presentation of data in food balance sheets.

Each of the commodity groups and subgroups discussed here is accompanied by its code number on an FAO database. It was first proposed to use a database called SUA (2). On further consideration, however, FAO suggested another database, called Commodity Balances Demand (CBD) (3). CBD presents, whenever feasible, the supply/utilization account of food commodities in a standardized form suitable for analysis. The code numbers given in parentheses for commodity groups and subgroups are therefore those of CBD.

Food Groups

FAO can present data to nutritionists in two ways. A weight basis (for example, in kg per caput per year) can reflect the commodity as reported or as converted to a primary product. Data are also presented in terms of energy and some of the main nutrients (protein, fat, carbohydrate and eight micronutrients). In this food-to-nutrient conversion, the food composition tables make some allowances for kitchen waste and other losses, and each commodity is presented as "ready to eat".

Cereals

CBD describes this group as cereals and products, excluding beer (2905). Most countries report on the several types of cereal data either as unprocessed primary products, or as flour (the first level of processing). FAO presents them as primary products. For nutrition purposes, the primary product level is best suited for the study of trends and comparison of levels of cereal supplies between countries.

In some cases, single cereals may be examined, preferably as unprocessed primary products. In Europe these cereals include:

- wheat (2511)
- rice (husked equivalent) (2512)
- barley (excluding beer) (2513)
- maize (2515)
- rye (2516)
- oats (2517).
The codes listed here cover quantities of both primary commodities and commodities derived from them, expressed as primary commodity equivalents. For example, the element “food” (141), under the code for wheat (2511) refers to all the quantities of food entered under wheat that are consumed as such, and to the wheat consumed as flour in bread, pastry and other products. All are expressed in terms of wheat equivalent.

Because most countries also report cereals as flour, it might have been possible to present cereals at this level of processing. In many cases, however, this could create confusion, as cereals are often brought into households not only as flour but also at a further level of processing.

Further, nutritionists might be interested in cereal products as consumed, such as bread. Although FAO may well have some data on cereals at this level of processing, these always refer to products exported from countries. The data would thus in no way be representative of the commodities available for consumption within the countries. This precludes the use of the database to study or compare cereal products at this level of processing.

**Roots and tubers**
In most of Europe, the group of starchy roots and products (2907) would more or less correspond to the supply of potatoes and related processed commodities, such as potato flour.

**Sugars and honey**
The data under the CBD code for total sugar (raw equivalent) (2827) do not include honey, which is a commodity of animal origin. The group comprises sugar cane and sugar beets in unprocessed forms, which are not of interest in a dietary context. The nutrition researcher should proceed to the commodity code for both raw and refined sugar (2542).

New sugar types used by the food industry, such as high-fructose syrups or various corn starch derivatives, cannot easily be identified. They are largely contained in figures reported for primary cereal products (such as maize or wheat), and deriving them independently would therefore be impossible. Some countries report data on glucose and dextrose (0172) or isoglucose (0175), but this is not done consistently and may not give a meaningful picture.

**Pulses**
Pulses and products (2911) comprise all kinds of pulses traded in dry form. The commodities in this group are nutritionally relatively homogeneous, and are used interchangeably in the diet. Potential users of data should work with the group as a whole.
Nuts and oilseeds

The group nuts and oilseeds (2061) corresponds to the sum of two subgroups: treenuts and products (2912) and oilcrops (excluding products) (2913). The group comprises nuts and various types of fruits and seeds commonly used to produce oil. These are included in the group when they are consumed as such, for example, as snacks and condiments. Although not a homogeneous group in a nutritional sense, in a dietary sense the group shares many characteristics. Potential users should therefore use commodity code 2061.

Vegetables

Vegetables and products (2918) form a very heterogeneous group. FAO presents data on them as the sums of the weight of the products in the form they are reported. Thus canned, dried, frozen and fresh vegetables are all reported together, although they differ in water content and nutrient density, and it is very difficult to convert them correctly into primary products. Because dealing with the group as a whole is not really meaningful, four subgroups might be useful in describing trends in dietary patterns. The first consists of the bulk of the vegetables often used in salads and eaten raw. Fine, raw vegetables (2062) include:

- lettuce (0372)
- spinach (0373)
- cucumbers (0397)
- green onions (0402)
- tomatoes and products (2601).

A second subgroup would consist of the coarser vegetables (2063), that have traditionally constituted almost a staple of the diet. Here, cabbage (0358) would be the best "indicator vegetable". For several nutritional reasons, following the supply of carrots (0426) in Europe would be interesting. Thus, carrots would constitute the third subgroup (2064). Finally, it would be interesting to follow the supply of the family of fresh pulses (2065). This fourth subgroup would include:

- green beans (0414)
- green peas (0417)
- green broad beans (0420)
- string beans (0423).
The whole group of vegetable commodities (2918) should be included for monitoring dietary patterns, keeping in mind its heterogeneity.

Fruits
Although fruits and products (2919) comprise a mixture of dried, canned and frozen fruits (excluding wine), the amounts are much smaller than those given for vegetables. Thus, the total figure for the group would give a reasonable picture of the supply from a dietary point of view.

Citrus fruits (2066) might form a subgroup. It would also include citrus juices, which are becoming increasingly important in many European countries. This would mean including the following commodities:

- oranges, tangerines and products (2611)
- lemons, limes and products (2612)
- grapefruit and products (2613)
- citrus fruit not elsewhere specified or included, and products (2614).

It is possible to go further in this commodity group to a separate examination of citrus fruit juices whose vitamin C content could be specified. This requires access to the micronutrient part of the database, however.

It may also be interesting to observe the use of traditional, coarse fruits (2067). These include apples and products (2617) and pears (0521) in northern Europe, and peaches (0534) and apricots (0526) in southern Europe.

Meat and offals
Meat and offals (2068) comprise two groups in CBD: meat and products (2944) and edible offals (2945). Here, the primary product level is misleading, as it relates to live animals. The first level of processing must be used, which describes commodities by carcass weight. Four main subgroups should be considered, as they differ in nutrient content or their place in the dietary pattern. The first subgroup consists of red meat (2069):

- bovine meat and products (2731)
- meat of sheep and goats and products (2732)
- pig meat and products (2733).
The second subgroup comprises poultry meat and products (2734), which include the meat of chickens, ducks, geese, turkeys and other poultry. Infrequently used meats comprise subgroup 3, and include the meat of horses, asses, mules, rabbits, game and other animals. This subgroup may be combined with subgroup 1. Subgroup 4 comprises edible offals (2934), including those of cattle, buffalo, sheep, goats, pigs, chickens, ducks, geese, turkeys and other animals.

The presentation of disaggregated figures for different kinds of meat would also be of interest. This would allow, for example, the comparison of pig meat with other types of red meat or the following of the supply of single types of meat over time.

Eggs
The total figure for eggs and products (2949) should be used, as eggs differ very little in composition and physiological effect.

Fish
Fish (2070) comprises two subgroups: fish, seafood and products (2960) and other aquatic products (2961). Statistics on fish are supplied to the food balance sheets by the FAO Fisheries Department. The data refer to an aggregate of edible varieties estimated by FAO. Further breakdown or disaggregation of the total does not seem meaningful; data on the categories of fish available in the data bank would, even when broken down, cover both fat and lean varieties. For special purposes, fish may be separated from other seafood. Otherwise, this group should be dealt with as a whole, and commodity code 2070 should be used.

Milk
The milk commodities (2948) in FAO food balance sheets do not include butter. The residual skim milk from butter and cream production is entered as skim milk (2739). Total milk production is expressed as whole milk equivalents, but refers to weight, not composition, as it includes milk with a lower fat content than that of whole milk (which is 3.5% or more).

In a dietary context, whole milk (2738) is of particular interest, as this group refers to all milk consumed fresh. Actually, this group, too, comprises milk differing in fat content.

Skim milk or low-fat milk used as a liquid for human consumption cannot readily be found on the database. The subgroup skim milk (2739) comprises all skim milk available as a raw product; this is the basis for many dairy products.
CBD does not have data on cheese. These can be worked out from the SUA database by analysing the element ‘‘food’’ (141) from the following commodities of differing fat content:

- cheese from cow’s milk (0901)
- cheese from skim cow’s milk (0904)
- cheese from buffalo’s milk (0955)
- cheese from sheep’s milk (0984)
- cheese from goat’s milk (1021).

Oils and fats
Oils, fats and products (2071) are divided into two groups: vegetable oils and products (2914) and animal fats and products (2946). Amounts are given in product weight. Oil is always a processed product, never a primary product. Data on total fat are of interest in nutrition research and practical work.

FAO can present an analysis of the composition of vegetable oils and products in three subgroups: polyunsaturated fatty acids, monounsaturated fatty acids and saturated fatty acids. So far, however, FAO has made somewhat restricted use of this presentation. Hydrogenated fats are usually accounted for at their least processed stage (before they are hydrogenated), for example, as fish oils.

Vegetable oils and products (2914)
Most countries report the supply of margarine from vegetable and other oils (1242). In addition, establishing three subgroups according to their main constituent fatty acids may be of interest. First, oils composed mainly of saturated fatty acids (2072) would include: palm kernel oil (2576), palm oil (2577) and coconut (copra) oil (2578). The second subgroup, composed mainly of monounsaturated fatty acids (2073), would comprise rapeseed and mustardseed oil (2574) and olive oil and olive residue oil (2580). Subgroup 3 comprises oils constituted of polyunsaturated fatty acids (2074):

- soya bean oil (2571)
- groundnut oil (2572)
- sunflowerseed oil (2573)
- cottonseed oil (2575)
- maize oil (2582)
- safflowerseed oil and other oils (2586).
Animal fats and products (2946)
Oils and fats from fish must be disaggregated from those of other animals, as they differ in composition and physiological effects. In fact, animal fats and products should be divided into three subgroups. The first comprises all animal fats: cattle fat, cattle butcher fat, sheet fat, goat fat, pig fat, pig butcher fat, lard, tallow and fat preparations. It should be noted that the term fat refers mostly to that still on the carcass, while butcher fat is that recovered from slaughter houses and used in various fat preparations.

The second subgroup covers butterfats: butter and ghee (2740) made from cow’s milk. Fish oils (2075) comprise the third subgroup: fish body oils and aquatic mammal oils (2781) and fish liver oils (2782).

Spices
Spices (2923) are of no consequence to the diet from a strictly physiological point of view, at least on a population scale.

Stimulants
The stimulants group comprises coffee and products (2630), tea (2635) and cocoa beans and products (2633).

Alcoholic beverages
Normally, FAO includes alcohol (2924) in its presentation of total energy (expressed in kcal per caput per day). The exclusion of alcohol is clearly stated when it occurs. Different types of alcoholic beverage can be presented:

- wine (2655)
- beer made from barley (2656)
- fermented beverages (2657)
- alcoholic beverages (2658).

The alcohol content of the last two commodities cannot always be exactly estimated.

Analysis
In the analysis of FAO data, the emphasis should be on demonstrating developments in food or dietary patterns that are interesting and meaningful in research supporting nutrition policy, and in the context of the WHO countrywide integrated noncommunicable diseases
intervention (CINDI) programme. The following are some initial steps in the analysis of the data; they provide the basis for the choice of further steps.

The food balance sheet data lend themselves first and foremost to a simple description of trends and levels of food supplies. FAO has applied a variance limit to the data, so that figures outside it have normally been checked by the time the data are submitted for the use of others. A linear presentation will be the most suitable for the assessment of trends.

**Time period**
All presentations should include the data available from FAO for the period beginning in 1961. This period is particularly interesting because it marks the recovery of most countries' food supplies from the effects of the Second World War, and the emergence of new patterns in food supply. For example, the Mediterranean diet started to deviate from its traditional pattern at this time.

**Food commodities**
Food supplies should be expressed in kg per caput per year. Using grams per caput per day may give a false impression of the accuracy of the measurement of consumption at the individual level.

Although it may be useful to start the analysis by looking at the trend in development over single years, showing three-year averages or three-year moving averages will be sensible in the final presentation. Even five-year averages usually show commodity trends clearly enough.

**Nutrients**
The percentages of total energy comprised by total supplies of fat, protein and alcohol are of special interest for a nutrition or diet analysis.

Changes in sources of fat over time should be studied by computing fat as a percentage of its contribution to total energy for groups of commodities as outlined above. A complete picture of the percentage contribution to total fat in the diet from each relevant commodity or group of commodities (called a fat profile) should be established, for the most recent three-year average available. The groups contributing most might then be further disaggregated to give more detail. A comparison of fat profiles over time may be made by selecting three-year averages from, say, the mid-1960s, the mid-1970s and the mid-1980s. Comparisons should be made of fat profiles between countries in different parts of the Region.
Countries
The food groups and analysis discussed here lend themselves mainly to countries with abundant food supplies. In principle, the population has enough to cover their nutritional requirements. All countries in the European Region, for which the analysis was originally made, are held to fall into this category.

References

Annex 4

A review of household budget surveys in 17 countries

W. Sekula

Bulgaria

Household budget surveys began in Bulgaria in 1925, and have been conducted systematically since 1952, under the responsibility of the Central Office of Statistics. The general purpose of the surveys is to study income and expenditure levels and patterns of food consumption.

Household budget surveys cover the entire country, including all administrative districts, and not only urban and rural populations but also all the major socioeconomic groups.

Surveys are conducted annually, and the reporting period is one month. In 1977, a rotation method of sampling replaced the continuous sampling conducted previously. Survey households are randomly selected through a two-stage sampling procedure. The information collected includes receipts for and expenditures on commodities and services. Quantities not only of purchased food but also of home-produced and bartered food are registered. Food consumed away from home is registered in money terms.

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*a When necessary, additional information was derived from: Review of food consumption surveys, 1985 (Rome, Food and Agriculture Organization of the United Nations, 1986), Review of food consumption surveys, 1988 (Rome, Food and Agriculture Organization of the United Nations, 1988), Review of national practices and methods of food consumption surveys (Rome, Food and Agriculture Organization of the United Nations, 1977 (unpublished document)). The author will be grateful for feedback enabling him to update this overview.
Denmark

The Central Statistics Office in Denmark has carried out a number of surveys of economic conditions in private households since the turn of the century. The latest household budget surveys cover 1966, 1971, 1976, 1981 and 1987.

In general, the purpose of the surveys is to study levels and patterns of income and expenditure, and specifically to obtain revised weightings for the consumer price index. Since 1976, the survey samples have represented all private households in Denmark (excluding Greenland and the Faroe Islands), regardless of the nationality of the head of the household. People living in institutions have been excluded.

For the 1987 survey, 50 000 addresses of private households were randomly selected from the Central Population Register. The participation rate was expected to be about 53%. The households were divided into 26 groups. Each group kept a total expenditure record over a period of four weeks. The record for food and drinks, however, covered only two weeks. The households were asked to record the food products purchased, and their quantities and prices. A combination of interviewing and accounting was used for data collection. The unit of tabulation was the household.

Finland

The Statistical Office has carried out household budget surveys about every five years since 1966, to study the structure of private consumption in Finland.

The latest survey was conducted in 1985 and the sample, like earlier ones, represented all private households in the country. For the 1985 survey, 11 800 people were selected from the Central Population Register; 8200 households provided fully acceptable data.

Data were collected by interviews and household records of expenditure for two weeks. In addition, home-grown and -gathered products were recorded. Information on the number of meals eaten away from the home was collected during the interviews. Before 1985, over 200 food items were recorded. These were further aggregated in the presentation of the 1985 survey results.

France

The Institut national pour la statistique et les études économiques periodically conducts household budget surveys to study living
conditions and the behaviour of different categories of the population of France. The latest survey was carried out in 1978/1979.

The sample represented all private households in the country and consisted of 10,645 households, which were surveyed from 6 November 1978 to 4 November 1979. The reporting period was 10 days; consumption and expenditure were recorded. Both the interview and record methods were used. Expenditure was reported for 12 groups of food and drinks and 40 food items.

Special food consumption surveys are carried out on a representative sample of private households in France. The most recent survey was conducted in 1982, covering more than 10,000 households representing the whole national territory. The objective of this survey was to measure the value and quantity of the retail food products consumed. Expenditure on 100 food items and the consumption of 76 food items were covered, including alcoholic drinks. The record-keeping period per household was one week. The results of the survey were published (in French) in 1986 by the Institut national pour la statistique et les études économiques.

Federal Republic of Germany

The Federal Statistical Office conducts sample surveys on income and expenditure in the Federal Republic of Germany at intervals of 3–5 years. Five such surveys have been carried out so far, in 1963/1964, 1969, 1973, 1978 and 1983. The purpose is to obtain a comprehensive view of economic and social conditions in private households.

The survey samples represent the entire territory of the country and all private households, with the exception of institutions and households headed by foreigners or with particularly high incomes. In the 1983 survey, the sample size was around 50,000 households, which had agreed to participate. The survey period was the calendar year. The recording period per household for food, drinks and tobacco was one month. The quantities bought and expenditure were recorded. The data were aggregated into 130 food items.

Greece

The National Statistical Services of Greece are responsible for household budget surveys. The first took place in 1957/1958 and covered only urban areas. The surveys conducted in 1974 and 1982 covered the entire country. A new survey was started in November 1987. The
surveys are intended mainly to obtain data on the levels and patterns of household expenditure. These data are used to revise the consumer price index.

In the 1974 and 1982 surveys, the samples were randomly selected from all private households. The 1982 survey covered over 6000 households in the period between November 1981 and October 1982. For seven consecutive days, interviewers visited selected households, recording the value of goods and services entering them. The quantities of the main food items were also recorded. The data were aggregated into 60 food items and 12 food groups, including alcoholic drinks.

Ireland

In Ireland, the Central Statistics Office has conducted household budget surveys every seven years, in 1973, 1980 and 1987. To monitor changes during the years between the large-scale national surveys, annual small-scale surveys are also carried out. A series of urban household surveys was conducted between 1973 and 1980.

The main purpose of the 1980 national survey was to determine the current pattern of household expenditure so as to update the weighting basis for the consumer price index. The survey represented all private households in both urban and rural areas of the country. The final sample was 7185 households. The reporting period was 14 days. Special questionnaires, expenditure diaries and farm account booklets were used. Food expenditure details covered 124 food items, excluding alcoholic drinks. This number was reduced to 51 in the final presentation.

Italy

Household budget surveys are conducted annually in Italy by the Istituto Centrale di Statistica. Their main objective is to study levels of consumption and expenditure so as to provide information for the national accounts.

The surveys cover all types of family, both rural and urban, but exclude people in institutions. A two-stage sampling design is used. In the 1984 survey, 3200 families participated each month, adding up to a total of about 38 500 families at the end of the year. The average response rate was 88.2%.

The recording by each family lasted 10 days. Data were collected using two survey forms, which described household expenditure item by item and in summary. Expenditure tables reported data for 22 food
items, including alcoholic drinks, while consumption data were presented on 15 food groups.

Netherlands

Since 1978, budget surveys in the Netherlands have been conducted annually by the Central Bureau of Statistics. The surveys serve several economic purposes and are used particularly to update the weighting scheme for the consumer price index.

Private households from all over the national territory were selected by a two-stage sample design. The sample comprised 2000 households in 1978 and 1979 and 3000 in subsequent years.

Each survey covered a calendar year. The reporting period was one month. Both interview and record-keeping methods were used. Households were required to record all expenditure. Expenditure was reported on 19 food items.

In 1987/1988, a survey focusing entirely on food consumption was carried out. A two-day record from a sample of about 2000 private households was obtained. It is planned to repeat this survey every five years.

Norway

Nationwide surveys of consumer expenditure were carried out in Norway in 1958, 1967 and 1973. Since 1974, household budget surveys have been annual. The responsible agency is the Central Bureau of Statistics. The principal aim is to give a detailed description of the consumption of private households so as to update the weightings used in calculating the consumer price index.

The samples are drawn annually in three stages from among all private households in the country, excluding institutions. Each year approximately 2500 households are selected; some 60% respond. Expenses are registered during a fourteen-day period by means of detailed accounting and an interview. The quantities and prices of purchased food and drinks, and the consumption of home-produced meat, fish and berries in the household are accounted for. Data are presented on 41 food items.

Poland

Annual household budget surveys are conducted by the Central Statistical Office in Poland. The main objective is to provide
information on the structure of households, levels and sources of income, and levels and patterns of household expenditure, food consumption and the use of durable goods.

The surveys cover households in all socioeconomic groups, but exclude institutions. A two-stage stratified random selection is made. Since 1983, the surveys have covered 5400 households in each quarter of the year. About 21,600 households are surveyed each year. In 1986, however, the sample comprised nearly 25,000 households; over 28,000 were covered in the subsequent year. The reporting period lasts three months. Data on household income, expenditure and food consumption are recorded in so-called budget books. These are collected and checked by the enumerators every two weeks. Monthly quantities per person are presented for approximately 70 food items or groups. Only food items that "enter" the households are included. Food eaten away from the home is recorded in money terms. Such meals, however, are included in calculations of the energy and nutrient content of the household diet, on the assumption that their content is the same as that of the meals eaten within the home.

Portugal

Household income and expenditure surveys were carried out in Portugal in 1967/1968, 1973/1974 and 1980/1981 by the National Institute of Statistics. Another was foreseen for 1989. The main purpose was to collect data for the calculation of new weightings for the consumer price index, for national accounts and statistics, and for studying the living standards of households.

The whole country was covered. A three-stage sample design was used. In the 1980/1981 survey, a sample numbering over 800 households was selected.

The households were interviewed every other day and kept a diary of daily expenses for a week. Data on quantities of purchases and home-produced foods were collected but not published by the National Institute of Statistics. Expenditure was reported for 12 food items in tables presenting households according to income, and for 51 food items in tables presenting households according to expenditure.

Spain

The National Statistics Institute carried out the most recent household budget and expenditure survey in Spain in 1980/1981. The main
objective was to revise the weightings for the calculation of the consumer price index. The survey results were also used in the national account statistics, and to study levels and patterns of consumption and expenditure and the sources and distribution of income.

The survey covered the whole country. A two-stage stratified sample design was used. About 28,000 households were selected, and the final sample amounted to 24,000 households. All types of private household in both urban and rural areas were covered.

The reporting period lasted for a week. A combination of interview and record-keeping methods was used. Data were presented on expenditure on 53 food items for food and on the consumption of 157 items, including alcoholic drinks.

Sweden

Studies of household consumption have been performed in Sweden since the beginning of this century, the most recent being the 1988 family expenditure survey. Similar surveys were performed in 1958, 1969 and 1978, or about every 10 years. Since 1985, the intervals have decreased to three years. A special survey on food alone was conducted in 1989. The findings of the surveys are used by various ministries, government agencies, private businesses, the labour market and cooperative organizations. The information provided on the composition of consumption is used to calculate weightings for the consumer price index.

In the 1985 and 1988 surveys, the sample included some 6000 households selected by the sampling of individuals, and then the inclusion of the members of their households. The sample was divided into 26 subsamples of equal size. A new subsample started its record-keeping every other week.

Information about expenditure is collected from household records kept for one month. Expenditure is largely recorded in detail; that on food, however, is recorded as a total, without a breakdown by item.

United Kingdom

Since 1950, the Ministry of Agriculture, Fisheries and Food has conducted the national food survey. It is a continuous sampling inquiry into the domestic food consumption and expenditure of private households in Great Britain. Annual family expenditure surveys have been conducted by the Department of Employment.
since 1953/1954, and cover all types of private household in the United Kingdom. Household recording lasts 14 consecutive days. The surveys have a number of purposes. The main official use of the data, however, is to monitor trends in household food consumption.

The sample of the national food survey is selected by means of a three-stage stratified random sampling scheme. The sampling frame covers the whole of Great Britain.

The reporting period is one week. Reporting weeks are spread over the year. The reference period in the tabulation is the year, stratified by quarters. Data are collected by personal interviews coupled with the maintenance of a diary record for a week. The quantities of and expenditure on individual types of food are recorded as purchased and, if necessary, reweighted in the household. Food is classified in 12 groups, each group being further divided into subgroups. Food consumption is expressed as expenditure, quantities consumed and nutritive value.

United States

Two surveys are carried out in the United States. The first is the consumer expenditure survey, which has been conducted since 1882; the second is the nationwide food consumption survey.

Previously conducted every ten years, the new, continuing consumer expenditure survey has collected data since September 1979. Data have been available on an annual basis since 1984. The surveys are carried out by the Census Bureau under contract to the Bureau of Labor Statistics.

The consumer expenditure survey has two components: a quarterly interview panel survey and a diary survey. Each component has its own questionnaire and independent sample. The interview panel survey is designed to obtain data on the types of expenditure over a period of three months that the respondents can be expected to recall. The diary survey collects expenditure on certain small, frequently purchased items for two consecutive weeks. Data are obtained on such items as food and drinks consumed within and outside the home.

Second, the nationwide food consumption survey is a data series that presents information about the types and quantities of food that households consume, as well as its monetary and nutritive value. This survey is conducted by the Nutrition Monitoring Division of the Human Nutrition Information Service of the US Department of Agriculture. For the last nationwide survey, in 1977/1978, the basic sample was a multistage, stratified probability sample of all households in the country. Information was collected from about
15 000 households. Personal interviews were conducted, using aided-recall questionnaires to record each food and drink used in the household for seven days prior to the interview.

Yugoslavia

Every five years, the Federal Institute for Statistics carries out surveys on household budgets in Yugoslavia. The results are used only for economic purposes. Data are collected four times a year in 6000 randomly sampled households. The survey sample comprises 19 000 households. The survey samples represent all households in the country. Socioeconomic groups are represented in equal numbers.

Data are collected on the quantities of purchased and home-produced food consumed in households. Data are also collected on expenditure on food eaten outside the home. The reporting period is one month in each season, totalling four months per year.
You are what you eat. People are aware that their diet affects their health and many try to ensure that they eat healthily. But the nutritional wellbeing of a nation also requires that decision-makers take health promotion into account when deciding on the population's food supply.

Such nutrition policies are a relatively new phenomenon in Europe. To develop them effectively, policy-makers need to know not only what people ought to be eating, but also what they are actually eating.

What do people eat, and who eats what? Food balance sheets, household budget surveys and individual-level studies all provide data on the dietary patterns of populations. This book makes a critical assessment of these data sources, examining what each can (and cannot) tell us and how they should be used.

Nutrition policies require an intersectoral approach, based on an awareness that all sectors have a potential effect on health. This book will be a vital guide to all those who could and should contribute to people's nutritional wellbeing: food producers and manufacturers, officials in ministries of agriculture, industry, trade and health, and individuals in positions that entail decision-making on food such as caterers, hospital administrators, and food importers and retailers.

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