

Dietary survey methodology of FINDIET 2007 with a risk assessment perspective

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Abstract

A cross-sectional survey, FINDIET 2007, was carried out in Finland. Food intake data was collected by a 48 h recall interview. Additional food intake data was collected by a repeated 3 d food diary, a barcode-based product diary, a food frequency questionnaire and by a supplementary questionnaire on rarely eaten foods. The purpose of the present paper is to describe the methodology of the national dietary survey and to discuss the particular implications for the applications of food consumption data in risk assessment. The food consumption data of the FINDIET 2007 survey can be used in food risk assessment, due thanks to flexible data processing of individual food consumption, and a risk assessment point of view was taken into account. However, international standardisation projects are needed in order to estimate comparable food intakes.

Keywords
Dietary assessment
Finland
Food consumption
Risk assessment

In the general framework of health promotion in the European Union, good health is linked both with a balanced food consumption and with the safety of the food supply⁽¹⁾. National dietary surveys are used for monitoring the food consumption and nutrient intake of population groups and for assessing potential food-borne risks, which arise from the intake of harmful substances like toxins or microbes, or the excessive intake of natural food components.

Food risk assessment is used to characterise the potential adverse effects on health resulting from exposure to food-borne risks over a specified time period⁽²⁾. In recent years, the idea of risk-based food safety management has increased the need for food risk assessment. Risk assessment-based food safety measures are designed to reduce risks to a target level⁽²⁾. These measures are planned in order to achieve an established level of human health protection. In order to quantify food-borne risks, an exposure assessment – as a part of risk assessment – is essential. For exposure assessment, demographically and geographically representative food consumption data is needed. In most countries, food consumption data used for risk assessment is collected in national dietary surveys.

The methodological development has faced new challenges, since the use of the data in national dietary surveys for risk assessment purposes increased in the mid 1990s⁽³⁾. The need to collect data in an internationally standardised manner has been recognised in European harmonisation projects⁽⁴⁾. The main challenge tackled is

the development of methods for assessing food consumption accurately, e.g. portion sizes, detailed food description, harmonisation of food classification and development of common data interchange formats for collaborative projects.

The aim of the present paper is to describe the methodology of the national dietary survey and to discuss the particular implications for the application of food consumption data in risk assessment.

Finnish national dietary survey

Data collection

The national FINDIET 2007 survey was carried out in a 33% sub-sample of the national FINRISK study, which is a cross-sectional population survey assessing the risk factors of chronic diseases^(5,6). For the FINRISK survey, a random sample of persons aged 25–74 years, stratified by sex, area and 10-year age groups was drawn from the population register. The survey covered five study areas in Finland representing 35% of the population. The survey included a health examination at the local health centre, and participants were asked to complete a questionnaire that covered questions on socio-economic factors, medical history, perceived health and lifestyle including the set of food questions.

Dietary assessment in the national FINDIET 2007 survey consisted of several elements: a 48 h dietary recall interview, a questionnaire for rarely eaten foods, a 3 d

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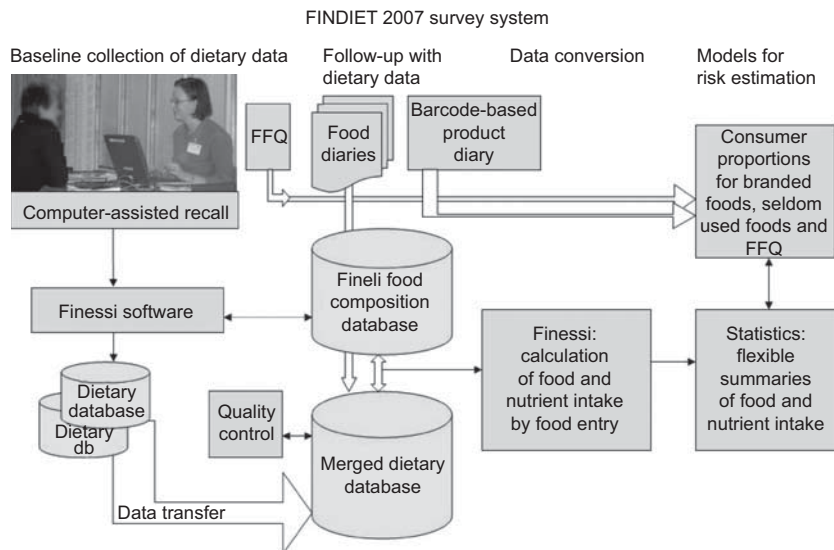


Fig. 1 Structure of the Fineli food composition data management and food consumption collection and dietary intake calculation and reporting system

food diary, and a barcode-based product diary⁽⁷⁾ (Fig. 1). All survey participants were invited to take part in the face-to-face, computerised dietary recall interview that was carried out by trained nutritionists. Dietary interviews covered the two consecutive days. All interviews were carried out between January and March.

Half of the FINDIET 2007 participants were asked to fill in the first 3 d food diary starting from the day following the dietary recall interview and the second 3 d food diary between June and October. Participants were asked to provide detailed information regarding the types and amounts of food, beverages and dietary supplements consumed during the 3 d period, and the time, location and type of eating occasion e.g. breakfast. A picture booklet^(8,9) and household measures were used to estimate portion size. Completed food diaries were returned by mail.

Half of the FINDIET 2007 participants were asked to keep a barcode-based product diary. Participants were instructed to record all food purchased by any member of the household for home consumption or by themselves for their own consumption for five consecutive days. Restaurant, café and fast food meals were not recorded. Participants were asked to provide detailed information regarding the purchased food, e.g. brand name, manufacturer, barcode and weight of the package. Completed product diaries were returned by mail.

All survey participants were asked to fill in a supplementary questionnaire in which they were asked to record how often they had consumed some rarely eaten food items, such as offal and reindeer during the preceding 12-month period. The aim of the questionnaire was to provide information regarding rare nutrient sources and the intake of polycyclic aromatic hydrocarbon compounds. The completed supplementary questionnaire was returned to the study nurses during the health examination.

Interview process for the dietary recall and the dietary software used

The dietary recall interview was carried out in two steps. The first step was a chronological review of eating occasions, where the names, times and locations of eating occasion were asked for and recorded using in-house software (Finessi, Fig. 2). In the second step, foods, beverages and dietary supplements consumed at each eating occasion were asked for and coded by the Finessi software. The photographs for the packages of the best selling margarine, yoghurt, juice and dietary supplement were available in order to help respondents in their recall. A validated picture booklet^(8,9) and household measures were used for portion size estimation.

The Finessi software was used for dietary data collection, food coding, assigning weights and calculating the nutritional composition of foods consumed. The software includes features such as an automatic quality control checker (e.g. to spot weights exceeding the maximum portion size of food), and a list of the most commonly consumed foods, which makes coding easier and quicker. A recipe modification feature is also available, but it is used by coders only if suitable for the purposes of study.

National food composition database

The Finnish national food composition database was used for the coding and calculation of dietary data⁽¹⁰⁾. The national food composition database comprises over 3000 basic ingredients and composite foods, over 500 dietary supplements⁽¹¹⁾ and over 300 nutrient factors. Part of this database has been published on the internet⁽¹²⁾ (www.fineli.fi). Information on brand-name foods is limited in the database. Composite food is defined in the database as food that has been cooked at home or prepared by the food industry or catering services. The recipes of composite

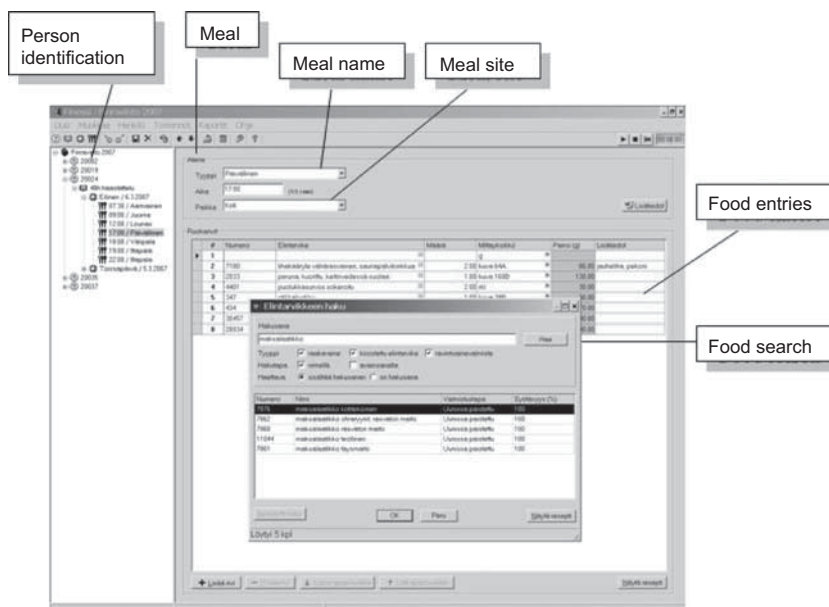


Fig. 2 Data entry for meal and food consumption data using the Finessi software

dishes are based on the best selling Finnish cookbooks. Nutrient losses during the preparation of food have been taken into account for vitamin A, vitamin C, vitamin B12, thiamine, niacin, folic acid, riboflavin and pyridoxine⁽¹³⁾. Data on contaminants, food additives or packaging materials is not included in the food composition database.

Two food classification systems were used for aggregating the data. A food use group is defined as a food group having common consumption characteristics⁽¹⁴⁾ (e.g. bread, meat, soups), whereas an ingredient group is defined as a food group having common origin in a particular foodstuff (e.g. wheat, beef).

The national food composition database is updated annually. However, the rapidly developing food market together with limited resources for database maintenance and food analyses makes updating it challenging and time-consuming. Food composition data has also been constantly harmonised according to the international recommendations⁽⁴⁾.

FINDIET 2007 survey system

The dietary survey system (Fig. 1) includes both food composition data and dietary data, which in turn contains details regarding the subject and consumed foods (Table 1). The common link between dietary data and food composition data is food identification, by which all consumed foods are converted into intakes of nutrients by the in-house software (Finessi). The dietary method, data collection and calculation procedures have been developed in combination with the food composition database. The concepts and frameworks of dietary database systems have been described earlier by other research teams^(15–17).

Table 1 The most important variables attached for each food entry of dietary interview

Variable group	Main specifications
Personality	Identification, gender, age group, reference group
Interview specification	Round of diet, date of interview, site of interview, interviewer, quality index, state of entered data
Day specification	Name of day, date, day of week, type of day
Meal specifications	Name of meal, time of meal, meal site
Food entry	Portion, unit, food entry order number, food identification number, food name, food type, processing status, edible portion, ingredient class, food use class, amount consumed
Calculated nutrients	Intake of each nutrient by entry

Discussion

A dietary method giving an approximation of the average food consumption and nutrient intake is considered applicable for national monitoring purposes. Therefore, 24 h and 48 h dietary recalls are widely used due to their good feasibility in the collection of individual dietary data⁽¹⁸⁾. Using data from dietary surveys in food risk assessment is very challenging since dietary surveys are not usually planned for risk assessment but rather for dietary monitoring⁽¹⁹⁾.

The main difference between dietary survey and risk assessment is that in dietary surveys the aim is to estimate average intake, whereas in risk assessment the whole intake distribution should be estimated. The variation in food consumption can only be covered by a short-term method if enough days are included or by a long-term

method assessing food consumption⁽¹⁾. When dietary surveys are planned, deciding the number of reporting days is essential both for accuracy and for costs. The number of reporting days is a crucial factor for risk assessment because a certain number of reporting days are needed in order to be representative at the individual level. This is important when proportions of users are used in the risk assessment models. The duration of surveys has been shown to only influence percentage estimates consumers and intakes among consumers but not mean total population intakes⁽²⁰⁾. Using a number of reporting days is also crucial in order to avoid any over-estimation of intra-individual variation. It should be also noted that intra-individual variation could also be underestimated if only a few consecutive days are available per participant. Therefore, repeated 24 h dietary recalls or food diaries should be favoured. In the FINDIET 2007 survey, the food consumption data was enlarged and augmented with food consumption data from the repeated 3 d food diaries. The combination of these two methods enables a better measurement of habitual diet.

The main challenge for risk assessment is that dietary survey methods are not primarily planned to estimate the intake estimation of non-nutrients. The aim of risk assessment is to estimate the absolute intake distribution of chemicals, and particularly the high end of the distribution. Therefore, the food frequency questionnaire is not suitable since it is best suited to categorise participants into low and high intake groups. Dietary recalls and food diaries are thus the methods of choice. These methods also have the advantage of itemised food identification, which makes it possible to assess acute exposure. The flexibility of Finessi software enables analyses of all specifications for meals and food items, even when the food composition is remodelled. Energy underreporting, however, can cause the underestimation of intake, and thus result in the underestimation of risk. However, no published data exists on the impact of underreporting on the intake of food chemicals other than nutrients.

Product use data is essential in the intake assessment of food additives and food contact materials, since there could be a large variation in food chemical concentrations between products due to variations in ingredients, additives and manufacturing processes. In addition, to plan an effective and representative sampling process for chemical analyses, product use data can be useful. Ideally, product information is collected in conjunction with 24 h recalls. In this manner, portion size information is also captured. However, with the barcode-based product diary the products used as ingredients for home-prepared foods can also be captured. The product use data has already been sought-after and proved to be useful in the consumption estimation of enriched food items.

The goals of dietary monitoring and food risk assessment can be taken into account in advance planning. In particular, the chemicals which are to be assessed should

be known in advance, as dietary surveys could be planned more specifically; e.g. if heterocyclic amines are of interest, data on cooking methods could be gathered in detail. At the moment the cooking methods are described only at a general level, e.g. grilled and not charcoal grilled in the food composition database. Food processing should also be taken into account, especially if food consumption data is used for microbiological risk assessment. In addition, the origin of foods is important, since concentrations of contaminants and plant protection vary geographically. There can also be significant differences in concentrations between organic and conventional foods.

Food classification is a key issue for risk assessment. It should be flexible, so that for each chemical or groups of chemicals a separate classification can be made. In most cases, food classification of ingredient level is the most useful approach. However, for substances formed in processing, classification based on food as eaten is the most useful approach. For pesticides and insecticides a classification based on raw agricultural commodities would be useful, but is seldom available.

The in-house Finessi software made the interview process easier, enabled quality control during data collection, and made the data quickly and efficiently available for further analyses. The same advantages have been described in previous studies^(16,17). The Finessi software is a multipurpose software that has been used successfully for the collection and calculation of dietary recalls, food diaries and food frequency questionnaires. On the other hand, the use of multipurpose software requires training because the software itself does not provide guidance on how to record dietary data for different purposes. The use of such software needs good knowledge of food codes, which makes training crucial.

In conclusion, the food consumption data of the FINDIET 2007 survey can be used in food risk assessment due to its flexible design and methodology. However, the use of food consumption data in national monitoring surveys for risk assessment purposes calls for special attention in the development of food descriptors, food classification systems and brand name databases, as well as combining several data sources in data analyses of food consumption. In addition, in future, methods used in food consumption studies and in food risk assessment should be internationally standardised, so that results can be compared and so that collaborative intake estimation can be carried out.

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