

# The Belgian food consumption survey: aims, design and methods

by

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## Abstract

*A national food consumption survey was organised for the first time in Belgium in 2004. A total of 3,200 individuals were interviewed. The target population contained all residents of Belgium who are 15 years or older. The individuals were selected by a multistage procedure from the National Register. Information on food intake was collected using two non-consecutive 24h recalls in combination with a self-administered food frequency questionnaire. Additional data on sociodemographic and lifestyle characteristics were obtained with a face-to-face questionnaire. Moreover information regarding food safety on household level was recorded. The fieldwork was spread over one year to anticipate seasonal effects and was carried out by trained dietitians. In this paper a general description of the aims, the design, the sampling procedure and the questionnaires of the Belgian food consumption survey are given.*

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## **Introduction**

More and more scientific evidence supports the role of nutrition in the risk of developing a large variety of non-communicable diseases. It is estimated that more than a third of cardiovascular deaths among people under the age of 65 is attributable to diet (1). Cancer accounts for 29 % of all deaths in men and 22 % of all deaths in women in the EU (2), and it is estimated that between 30 and 40 % of these can be attributed to dietary factors (3).

Evidence for the relation between incidence of disease and nutrition comes from studies comparing dietary and disease patterns in large population groups. Dietary intake information within a country can be collected using three different means: (a) food balance sheets, (b) household budget surveys and (c) specifically designed individual food consumption surveys. The food balance sheets provide information on type and amount of food available for human consumption within a country. Household budget surveys collect data on food availability within a nationally representative sample of households. Both food balance sheets and household budget surveys provide insight into food availability but do not assess food consumption at an individual level. Individual food consumption surveys estimate the food and nutrient intake of the participants and can provide information on the food quantities consumed by the individual. National food consumption surveys at the individual level can provide valuable information for usage in national nutrition policy and nutritional surveillance, e.g.: identification of subgroups within the population with unhealthy diets, studying the relationship of diet and health,...

The only nationwide individual dietary survey ever conducted in Belgium was the Belgian Interuniversity Research on Nutrition and Health (BIRNH) which was organised from 1979 until 1984 (4). Belgium together with Portugal has the oldest database on nutrient intake data on the individual level. Most European countries have carried out repeated national dietary surveys within the last decade (5).

In 2004 the National Food Consumption Survey (BNFCS) took place for the first time in Belgium. The study is financed by the federal government (the Ministry of Social Affairs, Public Health and Environment). The survey is carried out by the Unit of Epidemiology of the Scientific Institute of Public Health in collaboration with the National

Institute of Statistics, the Department of Public Health (University Ghent) and the Department of Cardiovascular Epidemiology and Health Promotion of the School of Public Health (Université Libre de Bruxelles).

The aim of this paper is to describe the objectives, the questionnaires and the sampling methodology of the Belgian National Food Consumption Survey (BNFCS).

### ***Objectives of the Belgian National Food Consumption Survey***

The two main objectives of the BNFCS are to monitor the nutritional adequacy of the food and nutrient consumption in Belgium and to monitor food safety aspects of the food consumption in Belgium. More in detail, the specific aims of the food consumption survey are for the first objective:

1. to provide information on the distribution of food and nutrient intake in the general population
2. to investigate the differences in meal pattern, energy intake and food and nutrient intake between different subgroups of the population (as defined by the socio-demographic and age variables) and to compare these with the recommendations
3. to identify subgroups at risk for a deficient or excessive intake of specific foods or nutrients
4. to compare actual food and nutrient intake with recommendations from the national dietary guidelines

And the specific aims regarding food safety are:

1. to provide a basis for estimating intake of contaminants, additives and other chemicals in food
2. to evaluate food safety practices in the household

A food consumption survey of this kind is an indispensable tool for different types of evaluation, risk assessment and policymaking decision algorithms in the field of food safety and nutrition. Therefore it is considered to be of high strategic value for different national governmental departments dealing with public health, nutrition and food policy. The results from this survey will also be of great help for research and for economical and agricultural policies related to public health nutrition policy.

### ***Study design***

The study design of this survey follows to a large extent the recommendations of the European Food Consumption Survey Method project (EFCOSUM) (6). The EFCOSUM project envisaged the formulation of recommendations with respect to harmonisation of the methodology for

collecting comparable food consumption data across Europe. The EFCOSUM project was undertaken within the framework of the EU programme on Health Monitoring. The EFCOSUM inventory on available food consumption surveys in Europe indicated that there is a regrettable lack of internationally comparable food consumption data. Therefore EFCOSUM prepared several pragmatic guidelines which make it possible to obtain more comparable data among the different European countries (7).

### **Data collection**

Information on food intake was collected using a repeated non-consecutive 24h recall (face-to-face) in combination with a self-administered food frequency questionnaire. Additional data on socio-demographic and lifestyle characteristics were obtained with a face-to-face questionnaire and information regarding food safety on household level was collected through a self-administered questionnaire.

### ***Assessment of dietary intake***

The 24h recall interview was proposed as the best suitable method for the purpose of monitoring food and nutrient intake in Europe by the EFCOSUM researchers (8). During a 24h recall interview, the types and quantities of all foods and beverages consumed over the preceding full day are to be reproduced by the respondent. Although a highly valuable tool, a single 24h recall has two major drawbacks in the context of food safety research - which in many instances requires data on "usual intake" and "intake among consumers only". A single 24h recall is not suitable for determining distributions of usual dietary intake as it lacks information on intra-individual variability in intake of foods. In contrast, it can validly be used for estimating the average dietary intake of a large group or population. In order to get more information of the within-person variation it has been advised to repeat the 24h recall at least once, thereby randomly covering all days of the week and to take such interviews over a 12 month period in order to cover all seasons of the year (9). Consecutive daily intakes are more highly correlated than non-consecutive daily intakes. A second major drawback of a single (or double) 24h recall method is that it does not allow to quantify proportions of non-consumers for particular food items, a fortiori for infrequently consumed foods. It has been demonstrated that combining a quantitative method (like a 24h recall) with a qualitative food frequency questionnaire (FFQ) can be a valuable substitute for more expensive and respondent-burdening dietary assessment methods (such as a 7-day or 14-day diary) (10). Linking information on population averages (from the 24h recall), proportions of consumers (from the FFQ) and distribution

characteristics (repeated 24h recall) is expected to enhance the quality and the usefulness of the survey for both nutritional and food safety purposes in a very substantial way.

In view of these considerations, in the BNFCs information on food intake was collected using a one time repeated non-consecutive 24h recall (face-to face) in combination with a food frequency questionnaire (FFQ) (self-administered) covering 60 food items. This one-year-survey was distributed equally over the seven days of the week in order to be able to assess effects of the day of the week and the seasons.

A 24h recall is an open-ended interview and for this kind of data collection standardization is highly essential. At this moment, EPIC-SOFT is considered the best validated software in Europe to obtain standardized 24h recall interviews (11). EPIC-SOFT was designed for uniform data collection in 10 European countries participating in the EPIC-study. EPIC-SOFT allows obtaining a very detailed description and quantification of foods, recipes, and supplements consumed in the course of the preceding day. In total 36,900 respondents were interviewed by 90 interviewers with EPIC. As was recommended by EFCOSUM, it was decided to use EPIC-SOFT in the BNFCs. The programme was adapted to the Belgian dietary context. The average duration of a 24h recall with EPIC-SOFT is about 30 minutes. Probing questions and entering consumed foods in chronological order supports the respondent's memory. The standardized structure prescribes possibilities of description and quantification of food items to choose from. The program enables the research interviewer to pursue a standardized interview to determine precisely what the participant had consumed in the previous 24 hours. Quantification of consumed foods is supported by the EPIC-SOFT picture book that comprises coloured photographs of foods in different portion sizes. The software provides an automatic coding of food items and recipe ingredients as well as calculation of nutrient intake. The 24h recall was repeated after 2 to 8 weeks (median 3 weeks).

In a food frequency questionnaire (FFQ) the respondent reports his or her usual frequency of consumption of specified foods over a certain period (usually over the last year). As already indicated above, the main objectives of the FFQ are to distinguish the consumers from the non-consumers and to generate estimates of intake of foods "among consumers", mainly for the purpose of food safety issues. Moreover the FFQ will be a useful tool to estimate food items usually eaten in a quick and easy way, allowing simple analysis of food habits of the participant. This might be useful in the future for monitoring with a small number of questions whether the population's diet is changing.

A self-administered FFQ has been developed specifically for the purpose of the BNFC. One of the problems in developing a FFQ is the level of detail in which food groups or food items have to be provided in the food list. As it is practically impossible to include all the Belgian food items in the food list, it was decided to include only general food groups and not specific food items. The categorization of the food groups was based on the Data Food Networking (DAFNE) III project (to make sure that our results will be comparable with other European Countries), as well as on the classification used in the Royal Decree of 13<sup>th</sup> March 2000 about the enactment of maximum levels of residues for pesticides tolerated in and on foods (12). The final conceptualization of the food list has been agreed on in consultation with the members of the scientific committee of the National Food Agency. Table 1 gives an overview of the 60 food items in the FFQ. The frequency questions used in this questionnaire are based on those used and advised by Willett (13), with the only exception that the frequency category "Never or less than once a month", used by Willett, has been separated into two different categories "never" and "less than once a month". The frequency category "never" is necessary when the objective is to distinguish consumers from non-consumers. The frequency categories used in this questionnaire are: never; less than once a month; 1 to 3 days a month; 1 day a week; 2 to 4 days a week; 5 to 6 days a week; every day; 2 to 3 times a day; and more than 3 times a day.

### ***Sociodemographic and lifestyle characteristics***

Each participant completed an individual face-to-face questionnaire related to sociodemographic and lifestyle characteristics. The first module obtains demographic information on all the members of the household: relationship to the reference person, age, sex and highest educational level of each member of the household. The other modules obtain information from the selected individual regarding: education, employment, smoking behaviour, leisure time physical activity, perceived health and prevalence of a list of five nutrition related diseases (diabetes, hypertension, hypercholesterolemia, cardiovascular diseases and food allergy) and measurement of waist circumference and methods used for losing weight. Sociodemographic parameters will be used to describe the study population and identify subgroups of interest within the population. The lifestyle characteristics are important to indicate to what extent less healthy dietary habits are related to other unhealthy lifestyle characteristics.

### ***Information regarding food safety on household level***

A household self-administered questionnaire evaluates food safety aspects at household level. This questionnaire was filled out by one member of the household who is usually involved in the preparation of the meals. One of the aims of the food consumption survey is to give information on food safety and food hygiene (e.g. information on microbiological risk factors in the preparation of meals) in the Belgian population. Additionally, the selected individual answered 6 questions regarding knowledge of safe food handling principles in the household. The Food and Drug Administration (FDA) conducted several national surveys about food safety topics (14). The 6 questions used in the BNFCs questionnaire were part of a FDA-survey in 1993 (14). The aim of this last set of 6 questions is to have an idea about the knowledge of the population regarding safe food-handling principles. This is important because consumer behaviour and awareness about food safety practices is important to prevent foodborne diseases. The information gathered by these questions can be of use in the development of recommendations regarding hygiene for the consumers at home. Furthermore the temperature of the fridge and the freezer, used in the household, was recorded.

### **The sampling procedure**

The target population is defined as all the people of 15 years or older residing in private households in Belgium. There is no upper limit concerning the age to be considered for the interview but children below the age of 15 years require a different approach and are therefore excluded from this survey (15). Due to (a) the selection of a sample frame and (b) practical considerations and decisions, not all persons belonging to this target population will or can be considered for the survey. This means that the study population – the population that can be defined accurately and reached in the study – does not cover the target population completely:

- As a consequence of using the National population register as the sampling frame, people not listed in the register (e.g. homeless) are excluded from the survey but also newly created households are sometimes not registered.
- Not only individuals, but also households are invited to participate in the survey. A household is defined as all people living at the address of the reference person. This implies that people not living with a reference person listed in the National Register are excluded from the survey.

As an update of the National Register is made every week, it is possible to draw 4 samples (one for each quarter) without the necessity to verify the situation of households. However, even when using the most actual version of the National Register, the real composition of a household can be different compared to the administrative composition due to the time needed for updating the Register and to households neglecting to inform changes in the household composition. The general guideline for the interviewers is that the real situation always overrules the administrative situation. This means e.g. that

- when an 'administrative' member left the household for a period of at least one year, he/she will be considered as not being a member of the household.
- compared to the administrative data, new members can have joined the household. As far as they are not considered as guests, they should be treated as being a member of the household.

The sample size has been defined based on sample size calculations. To allow description of food consumption in different predefined age-groups (15-18 y; 19-59 y; 60-74 y;  $\geq 75$  y) and in both genders, the sample should be stratified accordingly. Sample size calculations were based on an estimated mean intake for different nutrients to fall within a 5% interval around the true population mean with a 95% probability. These sample size calculations suggested inclusion of 400 individuals per age-gender stratum, resulting in a total sample size of 3,200 individuals for the entire survey. In this way, our sample size is much higher than the minimum recommended sample size of 2,000 adults in each European country by the EFCOSUM-group (7).

The sampling method follows a multi-stage procedure. The first stage is a stratification at the level of the provinces with the sample size defined proportional to the population size of the province. In this way 11 strata are formed: the 10 provinces and the Brussels metropolitan area. In the second step the primary sampling units (PSU), defined as the Belgian municipalities are selected within each stratum (province). By ordering (from large to small) and systematic sampling, the municipalities are stratified in blocks of a certain size and from each block just one municipality is chosen. As a consequence the chance for a municipality to be selected is proportional to the number of inhabitants. This systematic sampling guarantees that the larger cities are selected with certainty. In fact some large cities will be selected more than once because their size is a multiple of the step size by which the systematic sample is taken. By grouping smaller communities through ordering the whole set of communities according to size, the representation of small



villages out of the pool of smaller communities is ensured with the assumption that smaller communities of about the same size are exchangeable with respect to the items of interest. To keep the fieldwork feasible, each time a PSU is selected a group of 50 individuals needs to be interviewed successfully during the year 2004. Thus for a total sample size of 3,200 individuals, 64 PSUs are selected. Figure 1 shows a map of the 64 selected PSUs for the BNFCS of 2004.

In the last step, the individual or the second sampling unit is selected within each PSU. At the level of the municipality, a sample of 6.25 individuals in each age-sex strata is drawn so that groups of 50 individuals can be interviewed in total.

Not every sampled individual resulted in an interview. The reasons are variable: not eligible (e.g. moved out of the PSU), impossible to locate, refusal. In case of non-response the selected individual was replaced taking some considerations into account:

- to tackle, at least partially, systematic trends in drop-out, the individuals are not replaced in a simple random fashion, but by a priori matches based on the statistical sector within the municipality, the age of the person and the size of the household.
- to facilitate the organization of the fieldwork, three matches per individual are generated immediately.
- to cope with possible high rates of non-response, twice the expected number of matched quadruples will be sampled. Hence, the total sample size will be 8 times as large.

Selected individuals could be excluded during the recruitment when they were found ineligible a posteriori: institutionalized individuals (because of a reduced freedom in food choice), individuals unable to speak one of the three national languages (Dutch, French or German), and individuals who are physically or mentally not able to be interviewed were excluded from the samples at the doorstep. Proxy interview was not allowed because it is our opinion that a proxy is unable to provide accurate information on food intake of the selected individual.

## **Recruitment**

The selected individuals were invited by a letter accompanied by an information brochure. The brochure explained the aim of the study and what is expected from the respondents. Within two weeks after receiving this letter the subjects were contacted by a dietician who tried to make an appointment for the interview. The dietician was free to choose the manner of contacting the individuals (either by phone or at doorstep).

The outcome of the recruitment procedures can theoretically follow one out of four scenarios:

- The invited person is excluded at doorstep because he/she is found ineligible by the interviewer. The individual will be substituted.
- The invited person is eligible and is willing to participate (respondent).
- The invited person refuses to participate. The individual will be substituted.
- The invited person cannot be contacted after three attempts (of which at least one at doorstep, at least one during the weekend and at least one during the week after office hours). The individual will be substituted.

### **The interviewers**

The dietary knowledge of dietitians is very important for the quality of the dietary data (15). It is the experience of the Dutch food consumption survey that it is easier to train dietitians' interview skills than to train experienced interviewers in general nutritional knowledge (16). Therefore graduate dietitians living in or in the neighbourhood of the selected PSUs were recruited for the BNFCs. The interviewers were selected on the basis of their available time to spend on the fieldwork, willingness to carry out interviews on each day of the week and weekend, willingness to carry out interviews in more than one PSU, motivation and computer skills.

During an intensive training session of 2 1/2 days in January 2004, the interviewers learned to work with EPIC-SOFT and emphasis was put on standardization of data collection. All the procedures of the fieldwork and EPIC-SOFT were described in an exhaustive training manual for the interviewers. In addition regular newsletters were sent to the interviewers in order to clarify some points of interest raised during the course of the fieldwork or when an update of EPIC-SOFT needed to be installed.

### **Fieldwork**

The fieldwork of the BNFCs was distributed equally over the seven days of the week and over the whole year 2004 so that seasonal effects can be incorporated. To assure representativeness over time, interviews must be spread over the year so that each quarter is comparable in terms of number of successful interviews. Moreover all days of the week

(including Saturdays and Sundays) should be equally represented in order to account for day-to-day variation in food consumption (17).

During the first home visit, the dietician collected general information with the individual face-to-face questionnaire and the first 24h recall was obtained through a computer-assisted personal interview. The field-worker explained how to complete the self-administered questionnaires. The second 24h recall was obtained 2 to 8 weeks later. At that time the self-administered questionnaires were retrieved.

## **Conclusions**

In 2004 the fieldwork of the first Belgian food consumption survey since 1984 was organized. Information on food intake was collected using a repeated non-consecutive 24h recall in combination with a food frequency questionnaire covering 60 food items. During this one-year survey 3,200 residents of Belgium were interviewed and the whole of all sampling days was distributed equally over all seasons and the seven days of the week. The final report can be expected early 2006.

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TABLE 1  
Overview of the 60 food items in the FFQ

|    | Reeks voedingsmiddelen uit FFQ   | Série d'aliments du FFQ   |
|----|--|---|
| 01 | Water (leidingwater, flessenwater, ...)  | Eau (robinet, en bouteille, ...)  |
| 02 | Koffie, thee   | Café, thé   |
| 03 | Fruitsap, groentesap   | Jus de fruit, jus de légumes  |
| 04 | Light-frisdranken  | Sodas light   |
| 05 | Frisdranken  | Sodas   |
| 06 | Sportdranken (Isostar, Aquarius, ...)  | Boissons pour le sport (Isostar, Aquarius,...)  |
| 07 | Pepdranken (Redbull, ...)  | Boissons énergisantes (Redbull,...)   |
| 08 | Wijn (ook champagne en schuimwijn)   | Vin (aussi champagne et vin mousseux)   |
| 09 | Bier (ook alcoholarm bier)   | Bière (aussi sans alcool)   |
| 10 | Sterke dranken (Whisky, Cognac, ...)   | Alcools forts (Whisky , Cognac, ...)  |
| 11 | Andere alcoholische dranken (porto, cider, aperitieven, ...)                   | Autres boissons alcoolisées (porto, cidre, apéritif)  |
| 12 | Sojadranken, sojadeserts   | Boissons au soja, desserts au soja  |
| 13 | Melk in koffie of thee   | Lait dans le café ou le thé   |
| 14 | Melk (ook karnemelk, chocolademelk, ...)                                       | Lait (aussi lait battu, lait au chocolat, ...)  |
| 15 | Yoghurt, platte kaas   | Yaourt, fromage frais   |
| 16 | Snoep, chocola (ook candybars bv. Mars...)                                     | Bonbons, chocolats (aussi barre de Mars, ...)   |
| 17 | Koeken   | Biscuits  |
| 18 | Patisserie, koffiekoeken (fruittaartje, éclair, slagroomtaart, croissant, ...) | Pâtisseries, viennoiseries (couques p.ex. tartelettes aux fruits, éclairs, tartes à la crème fraîche, croissants,...) |
| 19 | Zaden, zadenpasta (zonnebloempitten, sesamzaden, ...)                          | Graines, pâtes à base de graines (tournesol, sésame, pignon de pin, ...)  |
| 20 | Noten, notenpasta (amandelnoten, pistachenoten, pindakaas, ...)                | Noix, pâte de noix (amande, pistache, arachide, ...)  |
| 21 | Gedroogd, gekonfijt fruit  | Fruits secs ou confits  |
| 22 | Fruit  | Fruits  |

|    | Reeks voedingsmiddelen uit FFQ   | Série d'aliments du FFQ  |
|----|--|--|
| 23 | Ontbijtgranen  | Céréales pour le déjeuner  |
| 24 | Wit brood, witte broodproducten  | Pain blanc, produits de boulangerie à base de farine blanche   |
| 25 | Bruin/volkoren brood, bruine/volkoren broodproducten                             | Pain gris ou complet, produits de boulangerie à base de farine complète                              |
| 26 | Zoete toespisjs  | Produits tartinables sucrés (choco, confiture,...)   |
| 27 | Kaas (geen platte kaas)  | Fromage (sauf fromage frais)   |
| 28 | Viswaren (gerookte vis, vissalades, visconserven,...)                            | Produits de la mer préparés (poisson fumé, salades de poisson, conserve de poisson, ...)             |
| 29 | Vleeswaren / charcuterie (gerookte vleeswaren, vleessalades, vleesconserven,...) | Préparations à base de viande / charcuterie (jambon fumé, salade de viande, conserve de viande, ...) |
| 30 | Eieren   | Oeufs  |
| 31 | Vegetarische producten (tofu, quorn, tempé,...)                                  | Produits végétariens (tofu, quorn, tempé, ...)   |
| 32 | Schaal-, schelpdieren  | Coquillages, crustacés   |
| 33 | Vis  | Poisson  |
| 34 | Orgaanvlees (lever, niertjes,...)  | Abats (foie, rognons, ...)   |
| 35 | Konijn en wild   | Lapin, gibier  |
| 36 | Gevogelte  | Volaille   |
| 37 | Vlees (schaap, rund, paard, varken,...)  | Viande (mouton, boeuf, cheval, porc,...)   |
| 38 | Rijst  | Riz  |
| 39 | Pasta, deegwaren   | Pâtes alimentaires   |
| 40 | Gefrituurde aardappelproducten (frieten, kroketten,...)                          | Fritures à base de pommes de terre (telles que frites, croquettes, ...)                              |
| 41 | Gebakken aardappelen   | Pommes de terre rissolées  |
| 42 | Gekookte en gestoomde aardappelen, aardappelpuree                                | Pommes de terre cuites à l'eau ou la vapeur , purée, ...   |
| 43 | Peulvruchten (bonen, linzen, erwten,...)   | Légumes secs (haricots, lentilles, pois, ...)  |

|    |  |   |
|----|--|---|
| 44 | Rauwe groenten   | Légumes frais   |
| 45 | Bereide groenten   | Légumes conservés   |
| 46 | Chips en gefrituurde snacks<br>(chips, borrelhapjes, kippenugget, ...) | Chips et snacks frits, (chips, amuse-geule, nugget de poulet,...) |
| 47 | Sauzen op basis van mayonaise (tartaar, béarnaise,...)                 | Sauces à base de mayonnaise (tartare, béarnaise,...)              |
| 48 | Ketchup  | Ketchup   |
| 49 | Margarine / minarine   | Margarine / Minarine  |
| 50 | Boter, reuzel, smout   | Beurre, saindoux  |
| 51 | Rauwe oesters  | Huîtres crues   |
| 52 | Rauwe mosselen   | Moules crues  |
| 53 | Sushi  | Sushi   |
| 54 | Gerookte visproducten  | Produits à base de poisson fumé                                   |
| 55 | Garnalen   | Crevettes   |
| 56 | Steak tartare  | Filet américain préparé   |
| 57 | Gehakt   | Filet américain non préparé                                       |
| 58 | Rauwe ongekookte melk (van de boerderij)                               | Lait frais cru (de la ferme)                                      |
| 59 | Zelfgemaakte mayonaise   | Mayonnaise préparé a la maison                                    |
| 60 | Zachte kaas op basis van rauwe melk (vb. Brie, Camembert, ...)         | Fromage au lait cru (ex. Brie, Camembert, ...)                    |

