

METHODOLOGY REPORT

Belgian Food Consumption Survey 2022-2023

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SUMMARY

This document provides an overview of the methods used to conduct the 3rd Belgian Food Consumption Survey which took place in 2022-2023. It starts with an overview of rationale for conducting the survey, presents the sampling methods, questionnaires and measurements, as well as the organisation of the fieldwork. The document presents the data management, sample characteristics and finishes with information on how the results are presented in the reports and on Sciensano's website.

1. INTRODUCTION

1.1. BACKGROUND

A healthy diet is essential for preventing several non-communicable diseases (NCDs) such as cardiovascular diseases, some cancers, diabetes type 2, and other conditions linked to obesity. Evidence shows the benefits of a diet with high consumption of fruits, vegetables, legumes, nuts and grains, and low consumption of salt, free sugars and fats, particularly saturated and trans fats (1). Moreover, a healthy diet should also avoid foods having an adverse effect on health due to the presence of micro-organisms, residues or contaminants (2).

To prevent and control NCDs, there is a need to develop and implement effective nutrition and food safety policies. In this context, the Food Consumption Survey is essential because it can serve to guide and evaluate policies. Through the regular collection of food consumption data, food consumption surveys provide insights into a population's consumption of foods and dietary changes. Combining these data with food composition data allows to model the intake of macro and micronutrients, assess the exposure to potentially harmful chemical or microbiological substances, and evaluate the environmental impact of the population diet. Furthermore, Food Consumption Surveys provide information that is needed for scientific research on associations between nutrition and health (2).

In Belgium, the first national Food Consumption Survey was conducted in 2004. Information on dietary intake was obtained from 3245 individuals aged 15 years and older (3). Based on the results of this survey, efforts have been taken to improve the Belgian food pattern with programs such as the Belgian National Food and Health Plan (2005–2010). In 2014-2015, a second national Food Consumption Survey was conducted in the Belgian population aged between three and 64 years (4). New food-based dietary guidelines were defined in 2019 for the adult population based on the results of the survey (5). Indicators of the Food Consumption Survey 2014-2015 serve as a baseline for the “Gezondheidsdoelstellingen 2025” in the Flanders Community. The results of the Food Consumption Survey 2014-2015 also urged other nutritional policy measures, e.g., school vending machines policies and the introduction of the Nutri-Score. Since food consumption patterns are subject to changes, regular monitoring of food consumption through food consumption surveys is needed, which is why the third Belgian Food Consumption Survey was carried out in 2022-2023.

1.2. OBJECTIVES

The main objective of the FCS 2022-2023 is to provide data on:

- the foods, beverages and food supplements consumed by the population,
- nutrient intakes,
- the percentage of the population meeting the dietary recommendations,
- the weight status of the population,
- physical activity and sedentary behaviour,
- eating habits, food-related perceptions and attitudes.

Providing high-quality data for estimating exposure and risk assessment to contaminants, additives and other chemicals in food is also part of the primary objectives of the survey. In addition, repeated collection of food consumption data will allow to gain insights into time trends in food consumption and eating habits in the Belgian population.

Compared with the previous survey conducted in 2014-2015, the Food Consumption Survey 2022-2023 included the following new features:

- two additional samples were selected – in Brussels and the German-speaking Community – and interviewed with a simplified data collection procedure, in order to be able to provide representative estimates in these regions, while limiting the cost of data collection;
- biological samples were collected in the survey population in the context of two annex studies;
- persons aged 65 years and older were part of the target population.

1.3. ACTORS

The Food Consumption Survey was commissioned and co-financed by different Belgian authorities competent in the field of public health. The assignment to carry out the Food Consumption Survey in 2022-2023 was determined in the framework of an Inter-ministerial Agreement between the Belgian Federal State and the Authorities (Regions and Communities) defined by the articles 128, 130 and 135 of the Constitution. The Inter-ministerial Agreement Protocol was concluded on 5th November 2018.

Conducting such large-scale research required the cooperation of different partners, each of whom contributed from their competence and experience to the success of the project:

- The **research team of Sciensano**, Scientific Directorate Epidemiology and public health, Department, Health information, Unit nutrition and health. This team was responsible for the implementation of the survey and was in charge of coordinating all phases of the project: survey preparation, development of questionnaires and manuals, interviewer recruitment and training, organisation and follow-up of the fieldwork, processing and analysis of the data and reporting of the survey results.
- The **Commission of Commissioners** consisted of all the commissioners' representatives of the study. This Commission monitors and assesses the progress of the project. As described in the Agreement Protocol, the Commission decides the content (modules and questions) and the methodology of the survey, provides indications regarding the statistical analyses based on the advices from the Scientific Committee, and defines the content of the final reports and evaluation. They also approve external request for the use of survey indicators or variables.
- **Experts from the Advisory Scientific Committee** provided feedback on the different stages of the survey (sampling, questionnaires, analytical strategy, results presentation). It ensured the scientific and technical follow-up of the study. The committee was composed of experts from universities and other organisations, as well as commissioners' representatives. The Advisory Scientific Committee is meeting at least once a year.
- **Researchers of the Dutch Food Consumption Surveys at the National Institute of Public Health and the Environment (RIVM)** (The Hague, Netherlands) provided support with respect to the configuration of the dietary intake software used (GloboDiet®), data processing, linking food consumption data with food composition tables and using the statistical programme SPADE® (Statistical Program to Assess Dietary Exposure).
- **Additional experts** were also consulted on an ad-hoc basis when deemed necessary (For example, experts with experience in conducting large-scale studies or expert with good knowledge of objective measure of physical activity with accelerometers).

2. METHODS

The Belgian Food Consumption Survey 2022-2023 is a national cross-sectional survey which was carried out by Sciensano in Belgium between March 2022 and December 2023. The methodology followed the general principles for the collection of national food consumption data established by the European Food Safety Authority (EFSA) in the framework of the EU Menu project, seeking to harmonise food consumption data between the Member States of the European Union (2,8). The fieldwork was carried out between the 1st of March 2022 and the 31st of December 2023.

The study received the approval of the Ethical Committee of the University of Ghent. Written informed consent was obtained from the participants (or their representative for children up to 17 years old) before the start of the interview. The study was conducted in accordance with the ethical principles for medical research involving human subjects (Declaration of Helsinki).

2.1. SAMPLE

2.1.1. Target population

The purpose of the sampling procedure is to select a group of individuals representative of the target population. The target population includes all people aged 3 years and older residing in Belgium, regardless their place of birth, nationality or any other characteristic. The National Register of the Belgian population was used as a sampling frame. The study population – i.e., the population actually covered by the National Register – does therefore not exactly coincide entirely with the target population. Indeed, people who not registered in the National Register (e.g., homeless or undocumented persons) were excluded from the study population.

In addition, certain people were excluded from the sample for practical reasons:

- people living in an institution (e.g., psychiatric institutions, homes for the elderly, nursing homes, psychiatric nursing homes), a religious community or cloister that shelters more than 8 persons, or a prison;
- people who moved out of the selected municipality after selection;
- people hospitalized during the survey period;
- people who did not speak Dutch nor French (except for the sample in the German-speaking Community);
- people who recently died;
- people who were not able to be interviewed because of a physical or mental disability.

This exclusion process took place *a posteriori*, when the interviewer had identified that the selected person was not eligible. Persons who were temporarily away from home (e.g., on vacation or temporarily hospitalised) were eligible for participation either by participating when they return home or by following them to their temporary address when possible.

2.1.2. Sample size

Sample sizes, and repartitions by age group, were decided together with the Commissioners and are defined in the Agreement Protocol. The size of the main national sample was based on the minimal requirements set by the European Food Safety Authority (EFSA), i.e. at least 260 participants – 130 males and 130 females – in each age group (8), and took into account budget and logistic constraints. To be able to provide estimates at the level of the Brussels-Capital Region, this region was oversampled. Similarly, to be able to provide estimates at the level of the adult German-speaking

Community, a specific sample was selected in East Belgium; this sample was restricted to the adult population (18-64 years).

Three samples were selected.

- In the **main national sample**, the goal was to reach 3020 effective participants, divided as follows: 1660 in Flanders (i.e. 380 children aged 3-9 years, 380 adolescents aged 10-17 years, 260 adults aged 18-39 years, 260 adults aged 40-64 years, 380 adults aged 65 years and more), 200 in the Brussels-Capital Region (i.e. 40 persons in each age group), and 1160 in Wallonia (i.e. 260 children aged 3-9 years, 260 adolescents aged 10-17 years, 190 adults aged 18-39 years, 190 adults aged 40-64 years, 260 adults aged 65 years and more).
- In **additional sample of the Brussels-Capital Region**, the goal was to interview 1240 effective participants, among which 260 children aged 3-9 years, 260 adolescents aged 10-17 years, 230 adults aged 18-39 years, 230 adults aged 40-64 years, and 260 adults aged 65 years and more.
- In the **German-speaking Community**, the goal was to reach a sample of 160 adults aged 18-64 years, including 80 adults aged 18-39 years and 80 adults aged 40-64 years.

2.1.3. Sampling procedure

The samples in Flanders, Wallonia and Brussels were selected according to a **multistage stratified sampling procedure**. This includes: (1) a geographical stratification by province; (2) a selection of municipalities within each geographical stratum (i.e., the primary sampling units (PSUs)); and (3) a selection of individuals within each municipality (i.e., the secondary sampling units (SSUs)).

2.1.3.1. Geographical stratification

The numbers of participants to be reached in Wallonia (i.e., 1160) and in Flanders (i.e., 1660) were each divided in five provincial strata, whereas Brussels was considered as a unique stratum. The target number of participants in each Flemish and Walloon province was determined proportionally to the population size of each province and rounded to the nearest multiple of 50 (Table 1).

Table 1 | Distribution of the sample across the eleven provincial strata, National Food Consumption Survey 2022-2023, Belgium

Provinces	Number of participants to be reached
Antwerpen	450
Vlaams-Brabant	300
West-Vlaanderen	300
Oost-Vlaanderen	400
Limburg	250
Brussels-Capital	200 (1450)*
Brabant Wallon	150
Hainaut	450
Liège	350
Namur	150
Luxembourg	100
Total	3100 (4350)*

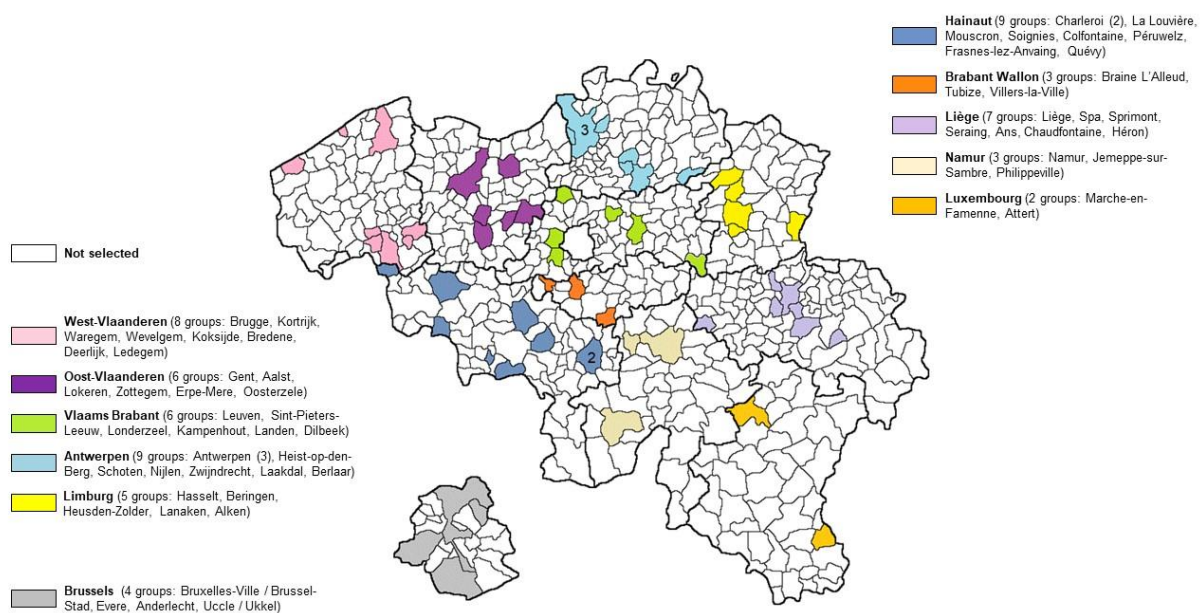
* including the additional sample in the Brussels-Capital Region

2.1.3.2. Selection of the municipalities

The Food Consumption Survey 2022-2023 was not organised in all Belgian municipalities. For practical reasons, in order to limit the number of interviewers, travel costs and the time needed for interviews, only a limited number of municipalities were randomly selected in each province.

The municipalities were selected using a clustered selection procedure. In each stratum, the number of participants to be reached was divided by 50 to determine the number of groups to be selected. The municipalities were selected using a method that combines probability proportional to size sampling and systematic sampling. In each municipality, one or multiple groups (of about 50 people to be surveyed) were selected (e.g., 3 groups were selected in Antwerp). This strategy ensures that big cities as well as small municipalities are selected. In total, 34 municipalities were selected in Flanders, 24 in Wallonia and 29 in Brussels (including the additional sample) (Figure 1).

Figure 1 - Sampling procedure of the FCS 2022-2023: selected municipalities in the main survey



* For the additional sample in Brussels, the following municipalities were selected: Bruxelles-Ville / Brussel-Stad (4), Scha.e/a.beek (3), Anderlecht (2), Molenbeek-Saint-Jean / Sint-Jans-Molenbeek (2), Ixelles / Elsene (2), Uccle / Ukkel (1), Woluwe-Saint-Lambert / Sint-Lambrechts-Woluwe (2), Forest, Jette, Saint-Gilles / Sint-Gillis, Etterbeek, Woluwe-Saint-Pierre / Sint-Pieters-Woluwe, Auderghem / Ouderghem, Saint-Josse-ten-Noode / Sint-Joost-ten-Node, Berchem-Sainte-Agathe / Sint-Agatha-Berchem, Ganshoren.

** The number between brackets gives the number of groups selected per municipality if more than 1 groups is selected in the respective municipality.

2.1.3.3. Selection of the individuals

Finally, 50 individuals were randomly selected within each municipality: the distribution per age and sex was defined using an algorithm in order to reach the target sample size by age group with half males and half females.

2.1.3.4. Specific sampling procedure in the German-speaking Community

Given the limited target sample size in the German-speaking Community and the smaller size of this area, a simplified sampling procedure was used. The target number of participants was split between

the North and the South of the Community, according to their population sizes: 98 individuals were randomly selected in the North and 62 in the South.

2.1.4. Substitution procedure

The participation was not compulsory. It is therefore possible that some of the selected people refuse to participate. It is also possible that selected individuals cannot be contacted by the interviewers, because they have moved, died or are associated with a non-existent address (despite the use of the most recent data from the National Register).

To compensate for potential non-participation, a procedure of substitution was used. For every selected individual, seven individuals – living in the same municipality and having the same sex and age – were selected as possible substitutes. These eight individuals were considered as a cluster. If the first individual in the cluster did not participate, the next individual in the cluster was then contacted. This continued until an individual accepted to participate or the cluster was exhausted. This procedure has the advantage of ensuring that the expected age and sex distribution is achieved, thereby reducing non-response bias related to age and sex in survey estimates (9).

2.2. QUESTIONNAIRES AND MEASUREMENTS

In this section we present the tools used to collect data. We first provide a general overview of all the methods used, highlighting the specificity of some age groups, and of the sample (i.e., main study versus additional sample). Then, we provide more detail about each specific measurement method.

2.2.1. General overview

Multiple measurement methods were used:

- two non-consecutive 24-hour dietary recalls;
- a questionnaire administered in a face-to-face interview setting (CAPI);
- a paper or online questionnaire handed out to participants for self-completion;
- the objective measurement of physical activity using accelerometers;
- anthropometric measurements;
- the sampling of non-invasive biological samples.

In adults and adolescents, questions were answered by the selected person. In children, the questions were answered by one of the parents or the guardian.

Tables A1 and A2, provided in the annex, outline the topics explored in the survey, together with their modes of collection and the age groups targeted, for both the main national sample and the additional sample in Brussels or the German Community. Questionnaires are available on the Food Consumption Survey website.

In the main national sample, the interviewers collected information from the participants through two face-to-face interviews conducted at the participant's home with an interval of 1 to 4 weeks between the interviews (Figure 2).

- **The first interview** involved conducting a first 24-hour dietary recall (for adolescents and adults) and gathering information on food supplement intake, sociodemographic characteristics, eating habits, food environment, physical activity and sedentary behaviour.
- **Between the two interviews**, participants were requested to complete a self-administered questionnaire, either online or in paper format. This questionnaire included a brief Food

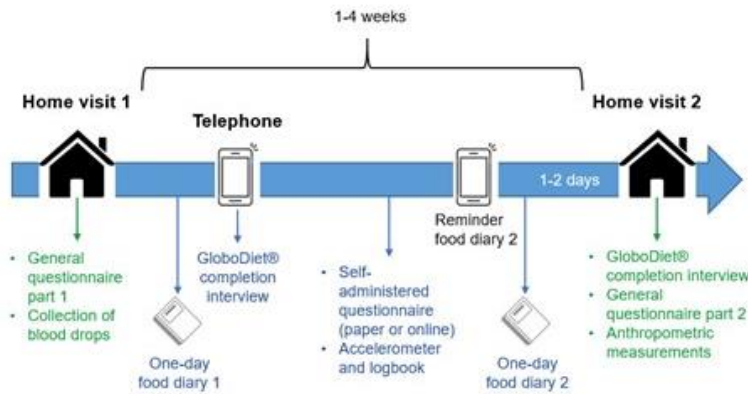
Propensity Questionnaire, along with questions regarding health and food security. Children and adolescents were asked to wear an accelerometer for seven consecutive days and to fill in a logbook. For children, the parent or legal guardian was requested to complete a one-day food diary twice in the period between the two interviews with at least 1 week separating the two record days. The first food diary was encoded during a telephone interview. The second food diary was encoded during the second interview.

- **During the second interview**, a second 24-hour dietary recall was conducted (in adolescents and adults) and measurements of weight, height and waist circumference were taken. Additionally, information on food safety practices, food environment and food policies were collected (Figure 2).

In the additional samples in the Brussels-Capital Region and the German-speaking Community, a simplified data collection procedure was implemented. The interviewers collected information from the participants during one single face-to-face interview conducted at the participant's home. The interview started with the completion of a comprehensive Food Frequency Questionnaire (including portion sizes), followed by anthropometric measurements and the completion of a questionnaire gathering data on sociodemographic characteristics, eating habits, physical activity, sedentary behaviour, food environment and food policies. Finally, the participant was asked to complete a self-administered questionnaire on health and food security (Figure 3).

Figure 2 - Data collection procedure for FCS2022-2023 in children, adolescents and adults, in the main national sample

Interview procedure in children (3-9 years)



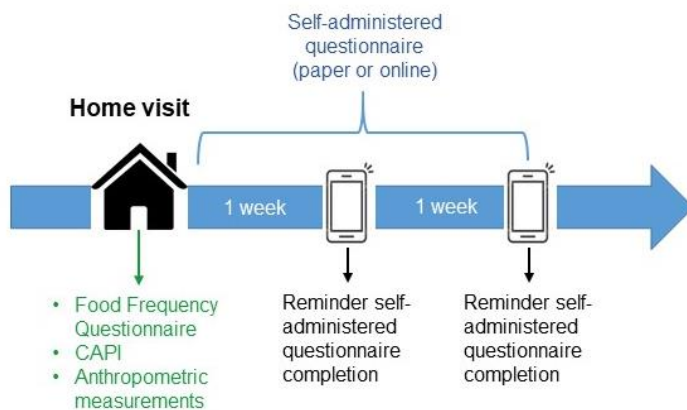
Interview procedure in adolescents (10-17 years) and adults (18 years and +)



*For adolescents aged 10 to 17 years old;

** for a subsample of adults aged between 18 and 64 years old.

Figure 3 - Data collection procedure for FCS2022-2023 in children, adolescents and adults for the additional samples in Brussels and the German-speaking Community



2.2.2. Food consumption data

2.2.2.1. 24-hour dietary recalls

In the main national sample, food consumption data were collected by means of two non-consecutive 24-hour dietary recalls. The 24-hour dietary recall is recommended by EFSA as the most suitable method for collecting comparable data on food and nutrient intake across different European countries (6;7). During a 24-hour dietary recall, respondents are asked what and how much they have eaten and drunk during the 24 hours preceding the interview (9).

A single 24-hour dietary recall is a snapshot and is therefore not suitable for determining distributions of “usual dietary intake” (the average dietary intake over a longer period) as it does not provide information on intra-individual variability (within-person variation) of dietary intake (10). To obtain more information on day-to-day variation, at least two 24-hour dietary recalls on non-consecutive days randomly spread over all days of the week and all seasons are recommended. The interval between the two 24-hour dietary recalls should be at least one week to obtain a better estimate of intra-individual variability.

A 24-hour dietary recall is an open inquiry, and for this type of data collection, standardisation is crucial to prevent and minimise systematic errors. Therefore, food consumption data were collected using the GloboDiet® assessment tool developed by the International Agency for Research on Cancer (IARC) (10). This software is a menu-driven software, allowing for a standardised conduction of interactive 24-hour recalls. It can be customised for various languages and countries while maintaining a high level of standardisation due to its structure including common files that remain consistent across countries (except for translation) and country-specific files that are adapted for each country according to a standardised structure (10). In addition, the GloboDiet® software has the asset to provide a high level of details on consumed foods through the use of different facets (conservation method, preparation method, sugar- and fat content, brand name, fortification, ...). Such details are essential and relevant for food safety consideration, such as assessing the risk related to the consumption of contaminants, additives, etc. GloboDiet® was also used in for the previous Belgian Food Consumption Surveys (under its former name EPIC-Soft)(11). An updated Belgian-specific version of GloboDiet® was prepared. Although GloboDiet® was developed by IARC, it is no longer maintained nor hosted. This means software changes are not possible and only previous users can continue to use the software.

Despite GloboDiet®'s structured and standardised approach, the presence of trained and experienced interviewers is essential to ensure the quality of the interviews. Interviewers must possess comprehensive knowledge of the foods available in the market and the typical recipes used within the study population (12). Therefore, interviewers conducting 24h recalls were requested to have a training in dietetics or to have a good knowledge in nutrition and a general interest in food. All interviewers received an extensive training in the usage of GloboDiet® (see section 2.3.3).

The 24-hour recall interviews performed with GloboDiet® are divided into five main steps:

- (1) the collection of general non-dietary information (i.e., name, ID-code, birthdate, sex, height and weight);
- (2) the creation of a chronological list of consumed foods and recipes (called “quick list”);
- (3) the description (e.g., cooking method, preservation method, packaging type, ...) and quantification of consumed foods and recipes using a picture book, household measurements (e.g., glasses, cups, spoons, etc.) and food portions provided by manufacturers;
- (4) quality controls at the nutrient level;
- (5) the collection of information on dietary supplement consumption.

The picture book used for food quantification included pictures from the EPIC-Soft picture book (12), the PANCAKE study picture book (13), the Swiss picture book (14), the picture book used in the

Netherlands (15), and the French national Food Consumption Survey (INCA3) picture book (16,17). The drawing of bread slices were developed in collaboration with the University of Gent as part of the 2004 Food Consumption Survey (18).

For participants aged 3 to 9 years old, food consumption data were collected through two non-consecutive one-day food diaries completed by the parent (or legal guardian). This was followed by a GloboDiet® completion interview, the first time by telephone and the second face-to-face at the respondent's home (Figure 2). The food diaries were required to be completed one or maximum two days prior to the Globodiet® completion interview. These diaries are open-ended notebooks (i.e., without pre-coded food lists) and are structured to recall different consumption occasions (i.e., before the breakfast, breakfast, during the morning, lunch, during the afternoon, dinner, during the evening, and at night). They contain tables where participants fill in the name of the food or drink consumed, its description, and the quantities consumed. The diaries include dedicated sections for describing homemade recipes and supplement intake, along with examples illustrating how to complete and contact details of the survey's responsible person. Quantification of food was facilitated using a picture book developed and validated for children aged 0 to 10 years (13).

2.2.2.2. Food propensity questionnaire (FPQ)

As recommended by EFSA (6), an age-specific self-administered Food Propensity Questionnaire was used to assess the usual frequency of consumption of specific foods over the past 12 months. The questionnaire was completed either online or using a paper version, depending on the internet literacy and access to an internet connection of the participant. The primary aim of the Food Propensity Questionnaires to differentiate between ever-users and never-users, thereby providing a more accurate estimate of habitual intake (6;10).

For the main national sample, the Food Propensity Questionnaire included 102 foods (96 for children for whom no alcoholic beverages were surveyed). The selection of foods was based on the lists used in the previous food consumption surveys in 2004 and 2014-2015 (13). The possible consumption frequencies were:

- (1) never;
- (2) less than 1 time per month;
- (3) 1-3 times per week;
- (4) 1 time per week;
- (5) 2-4 times per week;
- (6) 5-6 times per week;
- (7) 1 time per day;
- (8) 2-3 times per day;
- (9) More than 3 times per day.

For the same purpose, during the first interview, participants from the main study were asked about their usual intake frequency of 31 different **food supplements** during the last 12 months. The possible consumption frequencies were:

- (1) never;
- (2) less than 1 time per month;
- (3) 1-3 times per week;
- (4) 1 time per week;
- (5) 2-4 times per week;
- (6) 5-6 times per week;
- (7) every day;

If a particular food supplement was consumed, participants were asked an additional question regarding the specific months during which the supplement was taken in the last 12 months. If a supplement with vitamins or enzymes was taken, e.g., vitamin D, vitamin B12, B2, B5, B7, B9, C, vitamin K, ... was taken

at least once a month, participants were requested to specify whether it was taken during the last month. The reason why participants take the food supplements and the place of purchase were also asked.

2.2.2.3. Detailed food frequency questionnaire (FFQ)

In the additional samples of Brussels and the German-speaking Community, food consumption was assessed using a detailed semi-quantitative Food Frequency Questionnaire. The Food Frequency Questionnaire was specifically developed for the survey and was designed to capture total dietary intake by asking the frequency of consumption, along with portion sizes, of a defined list of food items. The main purpose of the Food Frequency Questionnaire is to allow comparison of food intake with dietary guidelines. The content validation of the Food Frequency Questionnaire, including understanding of the questions and methods for estimating portion sizes, was assessed during the pre-test phase of the survey.

2.2.3. Computer-assisted personal interviews (CAPI)

The other part of the interview was conducted through computer-assisted personal interviews (CAPI) using the “Offline Surveys” app which uses surveys created with LimeSurvey.

The interviewer read questions to the respondent and presented answer options on a response card. Responses were then directly encoded by the interviewer. In case of children participating in the survey, the interviewers used a “proxy interviewing” strategy, where the parent or caretaker of the child, answered on behalf of the selected participant. The topics covered by these questions are detailed in Tables A1 and A2 in Annex.

Each participant of the main national sample was interviewed twice (Figures 1 and 2). However, in the additional samples in Brussels and the German-speaking Community, only one CAPI interview was conducted (Figure 3).

The Computer-Assisted Personal Interviewing (CAPI) technique improves data collection quality and minimises errors by including automatic skips (for questions not applicable to certain respondents) and detecting incorrect or impossible answers. Additionally, the CAPI technique eliminates the need for subsequent data entry, thereby averting dataset errors, and reducing the need for additional quality checks. Respondents always had the option to refuse answering a question.

2.2.4. Self-administered questionnaire

Several topics were investigated using a self-administered questionnaire, including the Food Propensity Questionnaire (Tables A1 and A2 in Annex). This approach was used for two main reasons: (i) to avoid social desirability bias which might arise in face-to-face interviews, particularly in addressing sensitive topics, such as (mental) health; and (ii) for practical reasons, to limit the duration of the face-to-face interviews while ensuring coverage of all relevant study topics. Participants could complete the questionnaire either on paper or online, depending on their level of internet literacy and their access to an internet connection. In the main national sample, paper questionnaires were collected by the interviewer during the second visit, whereas it was completed on a tablet in the additional samples in Brussels and the German-speaking Community (if needed, with the assistance of the interviewer).

2.2.5. Sociodemographic characteristics, health behaviours and health characteristics

The first part of the CAPI-interviews, in both the national study and additional study in Brussels and the German Community, covered questions on the sociodemographic details of the selected individuals and their partners (or caregivers for children aged 3 to 17 years old). This included birthdate, sex, household type and size, highest educational attainment, occupation, language, nationality, and country of birth. Eating habits and other health behaviours were also investigated during home visits with

questions about breakfast consumption, involvement in meal preparation, watching television during dinner, pregnancy status, breastfeeding, and smoking behaviour.

Health characteristics were collected through the self-administered questionnaire using the Minimum European Health Module (MEHM) (19,20). This module includes three general questions covering different concepts of health: (1) the self-perceived health; (2) the presence of chronic conditions or long-standing health problems; and (3) activity limitations due to health problems. Additionally, participants were asked if they have been diagnosed with certain conditions in the past 12 months by a doctor or health professional, such as diabetes, high blood pressure, hypercholesterolemia (too much cholesterol in the blood), food allergy or food intolerance.

In adolescents and adults aged 18 years and above, mental health was addressed in the self-administered questionnaire using the five-item version of the Hopkins Symptom Checklist (21). For adolescents and adults aged 18-64 years, the questionnaire also covered weight control behaviours. This included questions about attitudes towards weight, methods used for weight loss and factors influencing the decision to control weight. Eating disorders were assessed using the SCOFF-questionnaire, which consists of five yes/no questions (22–24). In adolescents, the seven-item version of the Eating Attitude Test was also included to screen for symptoms of eating disorders, allowing a comparison with data from the previous data collection waves (25).

In adults aged 65 years and older, the self-administered questionnaire included the self-reported version of the Mini Nutritional Assessment (MNA) tool. This screening tool consist of five questions and includes an assessment of height and weight. It is used to identify the risk for malnutrition in older adults (26,27).

2.2.6. Physical activity and sedentary behaviour

Physical activity and sedentary behaviour were investigated using two methods: self-reported questionnaires (administered during the CAPI interview) and accelerometers (in children and adolescents only).

2.2.6.1. Main national sample

Adults

In adults aged 18-64 years old, the long version of the International Physical Activity Questionnaire (long IPAQ) was used, allowing comparison with the Food Consumption Survey 2014-2015. The long IPAQ includes 27 items providing detailed information on the different levels of physical activity across four domains: work, transportation, household tasks, and leisure time. Additionally, the long IPAQ includes questions on the average daily time spent sitting on a usual weekday and weekend day. This questionnaire was validated in previous studies across various countries (28–30).

In adults aged 65 years and more, an adapted, age-specific, version of the long IPAQ was used (33). This adaptation includes three key modifications: (1) in each domain, items on vigorous physical activity were combined with items on moderate physical activity (i.e. moderate-to-vigorous physical activity); (2) items on walking were completed with an item assessing gait speed (low, moderate or high pace), to differentiate between light and moderate intensity walking; (3) and items on recreational cycling (33).

In addition to sedentary behaviour measurements provided by the long IPAQ, adults aged 18-64 years were asked to provide contextual information on sitting time at work. Participants reported the average number of hours per day spent sitting at work during the past seven days (31). In addition, the Workplace Sitting Breaks Questionnaire (SITBRQ) was used to evaluate the frequency of breaks taken from sitting time at work (32).

Both adults aged 18-64 years and those older than 65 years were finally asked about their sitting time during leisure time. Participants reported their average daily sitting time spent: (1) watching films, videos, series, or playing video games; and (2) using a computer during leisure time, separately for weekdays and weekend days (31). In older adults, participants were also asked to report their average daily time spent in some additional sitting activities specific to their age group, such as reading, sitting hobbies like playing cards, doing crossword puzzles, knitting or listening to music (31).

Children and adolescents

The physical activity of children (3-9 years) and adolescents (10-17 years) was **objectively measured using accelerometers**. Self-report questionnaires are not reliable or valid in this age group to quantify physical activity and sedentary behaviour due to recall bias, social desirability (34) and the lack of tools with both satisfying methodological quality and good reliability and validity (35). Therefore, similar to the Food Consumption Survey 2014-2015, children and adolescents were asked to wear an Actigraph GT3X+ triaxial accelerometer, attached to an adjustable elastic waist belt on the right hip, for 7 consecutive days, between the two interviews (Figure 2). This accelerometer model (4.6 × 3.3 × 1.5 cm and 19 g) measures the accelerations caused by bodily movements in three axes: vertical, medio-lateral and anterior-posterior. While wearing the accelerometer, participants were instructed to fill in a non-wear activity diary (or logbook) to record their wake-up and bedtimes, as well as any periods and activities during which the accelerometer was removed (e.g., swimming lesson). The purpose of these diaries is to link the activities performed when the accelerometer was not worn to their corresponding energy expenditure in MET, to classify these activities according to their associated level of physical activity (sedentary, low, moderate or vigorous physical activity), and supplement the accelerometer data with the time spent in these different activity levels.

In addition to using accelerometers for children and adolescents, **self-report questionnaires** were administered to provide contextual information about physical activity and sedentary behaviour in these age groups. To ensure comparability with the previous survey, priority was given to the tools used in the Food Consumption Survey 2014-2015:

- For children, questions from the Toybox study (www.toybox-study.eu) (36) were used to gain insights into the participation of children in club sports, active transportation to school, outdoor play and screen-based activities.
- For adolescents, the Flemish Physical Activity Questionnaire (FPAQ) (37) was used to collect information on participation in sports, active (biking and walking) and passive (car, tram, bus) transportation, and sedentary activities during leisure time, such as watching TV, playing on a computer, surfing the internet, doing homework, reading, sitting hobbies and sitting while talking with friends.

2.2.6.2. Additional samples in Brussels and the German-speaking Community

Self-reported questionnaires only were used in the additional samples.

For **children**, the same questions on physical activity and sedentary behaviours as in the main national sample were used.

For **adolescents**, the level of physical activity was studied using two questions from the Health Behaviour in School-aged Children (HBSC) study (www.hbsc.org) (38). One question addressed moderate-to-vigorous physical activity: "Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? Please add up all the time you spent in physical activity each day.", with eight answer options ranging from 0 to 7 days. The second question focused on vigorous physical activity: "Outside school hours: how often do you usually exercise in your free time so much that you get out of breath or sweat?", with nine answer options ranging from never to more

than 7 times a week. These measures reflect current policy recommendations for physical activity in children and adolescents (39).

In **adults** (18-64 years and 65 years and older), the European Health Interview Survey - Physical Activity Questionnaire (EHIS-PAQ) (40) was used. This questionnaire is a short and domain-specific questionnaire assessing work-related, transport-related, leisure-time, aerobic health-enhancing and muscle-strengthening physical activity in a typical week (40). Validation against accelerometry revealed an underestimation of the moderate-to-vigorous physical activity, a moderate-to-strong validity (Spearman's $r > 0.41$) for work-related physical activity, walking, and health-enhancing physical activity, and fair-to-poor validity (Spearman's $r < 0.41$) for moderate-to-vigorous aerobic recreational and muscle-strengthening physical activity (41). Sedentary behaviours were assessed using the same questions as in the main sample across all age groups.

2.2.7. Anthropometric measurements

Weight, height and waist circumference were measured by the interviewers during the second home visit (or during the only home visit for the additional sample), following a standardised protocol and using specific devices. Participants were measured in light clothing and without shoes. Participants had the option to refuse the measurements. The results were recorded in the CAPI tool.

Body weight was measured to the nearest 0.01 kg using an electronic scale (type SECA 815 or SECA 804). Height was measured to the nearest 0.1 cm with a portable stadiometer (Type SECA 213), with the head positioned in the Frankfort horizontal plane. Waist circumference was measured to the nearest 0.1 cm with a non-stretchable measuring tape (type Meterex), placed midway between the lower rib and the iliac crest. Waist circumference was not measured in pregnant women.

2.2.8. Determinants of food choices

Contextual information was also collected to get a better insight into some determinants of food choices. In particular, there is a growing recognition that characteristics of the consumer and the food environment could influence the dietary intake of populations questions on the important aspects of the food environment were included in the survey (42). In the main national sample, as well as in the additional samples in Brussels and the German-speaking Community, the questionnaire for children and adults included questions on:

- **Perceived determinants of food choices:** aspects (taste, convenience, etc.) important when shopping for food (questions adapted from the Perceived Nutrition Environment Measures Survey);
- **out of home consumption:** frequency of consumption of meals from fast-food outlet, restaurants and home-delivered meals;
- in children: **marketing towards children** (derived from the International Food Policy Study);
- use of **food apps** to select food items
- use and perception of the **Nutri-Score and food labels** (44,45)

The questionnaires of children and adults also covered the topic of **food policies** by asking the participants (or their representatives, in case of children) what actions the governments (European/federal/regional/local) could take to support them in consuming a healthy diet. This information aims to assess the extent of public support for various policies promoting healthy eating in Belgium. The questions were updated from those asked in the Food Consumption Survey 2014-2015.

The survey also introduced the topic of **food literacy** by incorporating the Food Literacy Screener (FLS), developed by the KULeuven (43), into the children and adult questionnaires across all samples. This tool includes questions assessing the skills, knowledge and behaviours related to food planning, selecting food items, preparing and eating food, as these aspects have been identified as necessary to achieve a diet aligned with nutritional recommendations.

Food insecurity was assessed using the 3 screening questions derived from the USDA Household Food Security Survey Module. The questions were adapted for adolescents.

2.2.9. Food safety practices

In the main national sample, questions on food safety practices were included in the CAPI of the second home visit of children and adults aged 18 and older. The questions covered the following issues: hand washing before preparing food, frying of meat and chips, 'use-by' and 'best-before' dates, and conservation of meat and leftovers. Participants were required to answer these questions only if they were involved in meal preparation.

2.3. ORGANISATION OF THE FIELDWORK

2.3.1. Duration of the fieldwork

Initially, it was planned to spread the fieldwork over the four quarters of 2022. However, due to delays in the preparation phase, the fieldwork started in March 2022. After one year of fieldwork, only 1117 participants – or 37% of the total target – was reached. Consequently, the fieldwork was extended until the end of December 2023. By this date, the number of participants was 2809 for the main national sample (91% of the target), 968 for the additional sample in the Brussels-Capital Region (77% of the target), and 161 for the additional sample in the German-speaking Community (101% of the target).

2.3.2. Recruitment

Selected individuals were **invited by post** to participate in the survey. The invitation letter was accompanied by a brochure with information about the objectives and content of the survey.

Interviewers received contact details of the selected individuals (including name, age group and address) through a **secure application protected with a password**. Selected individuals had the opportunity to provide their telephone number to the interviewer through a website link or QR code.

Upon receiving the invitation letter and brochure, individuals were **recruited** by an interviewer, either **face-to-face or by telephone** if their telephone number had been provided. This initial contact served as an opportunity to further explain the study, determine the eligibility of the selected person and obtain consent for participation.

At least three contact attempts had to be made before considering an individual as non-contactable: among these attempts, at least one had to consist of a home visit, one had to occur during the week-end, and one had to occur during the week in the evening (i.e., from 6 PM). **Each contact attempt**, whether successful or not, was recorded by the interviewer in an **online form** dedicated to fieldwork monitoring. This form allowed for individual (at the interviewer level) and overall (at the survey level) fieldwork progress to be tracked, and enabled the identification and automatic replacement of non-participants (due to refusal, non-eligibility, or failure to contact) among the selected individuals.

The participants received a 40 euro gift card as an **incentive** (initially the gift card was 10 euro, but this amount was increased at the start of 2023 aiming to increase the participation rate).

2.3.3. Interviewers

To ensure data quality and reliability, all interviewers working followed a **training**. For the main national sample, the training lasted three days; for the additional samples it lasted one day.

For the main national sample, on the first day, interviewers received general information about the survey, details about the interview procedure tailored to each age group, guidance on data collection methods, instructions on the instruments used during the interviews (software, measurements, biological samples, etc.) and programs for the transfer of data, as well as an overview of their roles as interviewers (recruitment, presentation of the survey, etc.).

During the second and third training days, the interviewers received specific training on the GloboDiet® software. Between these training days, interviewers were required to make GloboDiet® exercise interviews at home. In addition to the training sessions, comprehensive manuals were provided detailing all fieldwork procedures, software explanations, and GloboDiet® functionality.

To ensure the quality of the 24-hour recalls, the initial GloboDiet® interviews conducted by each interviewer were evaluated, and a feedback meeting was scheduled. Interviewers were informed of any areas of improvement. Throughout the fieldwork, interviewers' performance was monitored weekly, including data flow and various performance indicators such as recruitment and interview rate, interview duration, and dietary information accuracy. Interviewers received monthly follow-up, primarily via telephone, and occasionally via email, on their work as interviewers and to address any potential issues. If necessary, closer monitoring was implemented. This monitoring enabled rapid identification and resolution of any arising issues.

For the **study conducted in Brussels and the German-speaking Community**, a one-day training was sufficient due to the simplified interview procedure and the absence of 24-hour recalls. This training focused on explaining the Food Frequency Questionnaire, the general questionnaire, and anthropometric measurements. Interviewers were also trained in using the necessary instruments for conducting interviews and transferring the data, as well as understanding their role as interviewer.

Each interviewer was provided with a **comprehensive manual** detailing all procedures involved in data collection and transfer. Similar to the main study, the work of the interviewers was monitored weekly. Additionally, appointments were scheduled to address any emerging issues and to provide feedback on their performance.

Furthermore, **newsletters** were regularly sent to the interviewers during the study. These newsletters informed the interviewers about the progress of the research and described any issues related to the GloboDiet® program or other programs (such as common errors) and updates of the software used. Additionally, several "**follow-up days**" were organised to directly interact with the interviewers and potentially adjust procedures based on any issues encountered. These days also provided interviewers with the opportunity to meet each other and share their experiences (for example, regarding participant contacting).

The quality of work of the interviewers was assessed by contacting some of their respective participants who agreed to provide their contact details (phone number). This quality check allowed to investigate if the interviewer had indeed visited the participant and followed the study procedures effectively.

2.4. DATA MANAGEMENT AND QUALITY CHECKS

2.4.1. Datasets

Several datasets are created:

- The “LimeSurvey” dataset includes all the data collected with the LimeSurvey questionnaires, during face-to-face interviews or via the online self-administered questionnaires answered by the participants themselves. Paper self-reported questionnaires were scanned and the resulting data were merged with the data coming from the online questionnaires.
- The “Accelerometry” dataset includes the data registered by the accelerometers worn by the children and adolescents, as well as the information reported by the participants in the logbooks. All the logbooks were encoded manually by means of a LimeSurvey questionnaire.
- The “GloboDiet®” dataset includes the information collected during the two 24-h dietary recalls, i.e., the amounts of foods and supplements consumed during the two recall days, as well as the related amounts of macro- and micronutrients. These contents were derived from the linking of the initial dataset with food composition tables.

2.4.2. Cleaning of the datasets

A “vertical” check of the collected data was carried out during the fieldwork, for each dataset separately. The main purpose of this check was to verify the accuracy of the identification numbers (or “*id*”) allocated to the respondents. This *id* number could for instance be incorrect due to encoding errors. It is essential to check and correct it so that the various datasets could be linked together, thereby ensuring the quality of the subsequent analyses. From a practical point of view, the “vertical” check of the datasets mainly consisted in verifying that the *id* numbers existed in the global sampling file and were reported as interviewed by the interviewers in their roadmap. If it was not the case, the interviewer was contacted to identify the error and correct it. The presence of duplicates was also controlled. When two or more entries with the same *id* numbers were found, we verified if the entries were related to the same individuals or different participants (based on the sex or the birthdate, for instance). In case of actual duplicates, we kept the more complete or the most recent entry; in case of different participants, we tried to identify the *id* number of the person for which a wrong *id* was encoded.

Quality control was also carried out to check for each individual the consistency of the context variables (mainly postcode, age and sex) and the answers given to the various questionnaires (if it was a child, did he or she answer the questionnaires designed for children?) Once again, research was carried out to identify errors and make the necessary corrections. Inconsistent answers that could not be corrected were considered as missing. In addition to this general cleaning, a new step of control was performed when analysing each module (i.e., each analysis theme). The internal consistency of the data within each module was controlled. When outliers or inconsistencies were identified, investigations were carried out to find their origin. If it was not possible to correct the problem, the problematic data was considered missing.

2.4.3. Specific cleaning and preparation of the GloboDiet® dataset

In addition to the vertical control described above, the GloboDiet® dataset required a specific cleaning procedure. This procedure took place in several stages. The first correction stage involved reviewing the notes generated automatically by the GloboDiet® software or entered manually by the interviewers. This involved, for example, specifying certain quantities that had not been entered, giving details of a food consumed, checking the accuracy of a new recipe, new foods or supplements entered in the software. Encoding errors were also corrected. Each correction made was coded and described in an Excel file for record-keeping purposes.

The consistency of the brand names recorded was also checked (e.g., spelling) in order to facilitate subsequent data processing. Quality control was also carried out on the dietary supplements recorded: this involved specifying certain supplements that had not been specified by the interviewer, checking new dietary supplements added to the software by the interviewers or checking the encoding of certain volumes (dosage in teaspoons, drops, ...). For each participant, the length of the interval between the

two 24-h recalls was checked in order to retain only the participants with two non-consecutive dietary recalls.

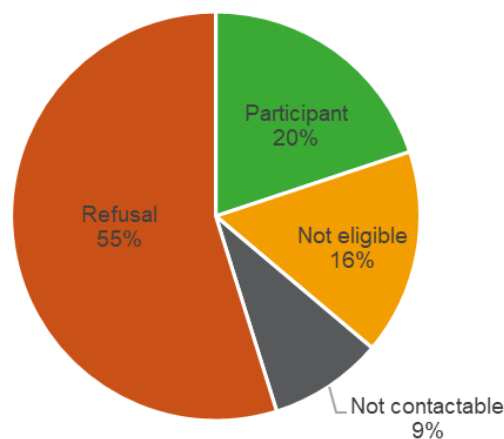
The GloboDiet® software registers the type and quantity of food items and supplements consumed by an individual, and provides a large amount of qualitative information about the products consumed (the cooking method or storage method, for example). However, this software does not provide the energy and nutrient intake (proteins, lipids, etc.) corresponding to the foods consumed. To obtain such information, the food consumption data collected via the GloboDiet® software were linked with food composition tables. The Nubel (Belgium) and Nevo (Netherlands) composition tables were used, with a priority given to the use of Nubel when detailed enough information was available. For dietary supplements, the GloboDiet dataset was linked to a database created on the basis of the various dietary supplements consumed by the Belgian population and their composition.

2.5. PARTICIPATION

The participation into the Food Consumption Survey was not compulsory. The persons invited to participate could therefore refuse to take part. The status of each person invited to participate into the survey (refusal, unreachable, ineligible, participant) was recorded by the interviewers in their roadmap.

In total, 18,392 persons were invited to participate into the main national survey and the survey in Brussels (thus excluding the German Community in this analysis). This figure includes the persons who received the invitation letter and for which a final status was defined (i.e., refusal, not contactable, not eligible, or participant). Among them, 20% accepted to participate (while being eligible), 55% refused to participate, 9% could not be contacted (after at least three attempts on different days and at different time), and 16% were not eligible (Figure 4). The individuals contacted were not eligible for various reasons: when the selected address was not found, when the person did not live at the selected address (e.g., when they moved home) or when the person did not meet the selection criteria (if they neither spoke French nor Dutch, or live in a psychiatric institution, for example).

Figure 4 | Distribution of the selected individuals according to their final status



The participation rate, calculated as recommended by the European Food Safety Authority (EFSA), is the ratio between the number of participants and the sum of eligible (i.e. participants and refusals) and not contactable individuals (8). For the current survey, this participation rate is 24% (in the main national sample and the additional sample in Brussels), which is a decrease compared to the participation rate of 37% observed during the previous survey conducted in 2014-2015.

The cooperation rate is the ratio between the number of participants and the number of eligible persons (i.e. participants and refusals) (8). While the cooperation rate remained stable between 2004 (42%) and

2014-2015 (43%), it fell sharply between 2014-2015 and 2022-2023: indeed, in the current survey, the cooperation rate reaches only 27% (in the main national sample and the additional sample in Brussels). Which means a large proportion was not eligible. This could be explained by the fact that Brussels was over-sampled in this study, resulting in more people having moved home, and more people without a sufficient knowledge of French or Dutch to take part to the study.

Finally, the contact rate was also calculated; this is the ratio between the number of eligible individuals and the sum of eligible and not contactable individuals (8). This rate is 89% in the current survey (in the main national sample and the additional sample in Brussels), which means that a large proportion of the individuals selected were able to be contacted by the interviewers. This contact rate is greater than the one observed during the previous survey in 2014-2015 (85%).

2.6. COMPOSITION OF THE STUDY POPULATION

2.6.1. Composition by province

For the main national survey, the objective was to interview 3,020 individuals (while sampling 3,100 individuals), spread across the eleven Belgian provinces (including the Brussels-Capital Region). For the survey in Brussels, the goal was to reach 1240 participants (while sampling 1250 individuals). Table 2 illustrates the geographical distribution of the participants, compared to the distribution observed in the Belgian reference population.

For each province, the aim was to interview a number of individuals proportional to the size of the population of the considered province. Because participation rates varied from one province to another, there are differences between the distribution by province in the sample of participants and that observed in the Belgian population. For instance, we observe an underrepresentation of persons living in the provinces of Antwerpen, Oost Vlaanderen, Liège and Namur in the participant sample. We also observe an overrepresentation of persons living in the Brussels-Capital Region: this is related to the additional sample selected and interviewed in this region to be able to provide representative results at this level.

Table 2 | Distribution of the Belgian reference population and the participant sample by province, National Food Consumption Survey 2022-2023, Belgium

Provinces	Percentage (%) in the Belgian population*	Percentage (%) in sample of participants
Antwerpen	16.3	11.5
Vlaams Brabant	10.2	8.2
West Vlaanderen	10.4	9.9
Oost Vlaanderen	13.4	8.3
Limburg	7.7	6.5
Brussels-Capital	10.6	29.9**
Brabant Wallon	3.5	3.8
Hainaut	11.5	10.5
Liège	9.5	6.3
Namur	4.3	2.7
Luxembourg	2.5	2.6

* Belgian population aged 3 years and above, at 1st January 2022.

** including the additional sample in the Brussels-Capital Region

The differences observed have been taken into account in the calculation of the weighting factors (see Section 2.7.1) in order to restore the representativeness of the sample by province according to the actual composition of the Belgian population.

2.6.2. Composition by age and sex

The stratification of the sample by age and sex has been performed in order to reach specific targets based on European guidelines, budget constraints and available logistic means (see Section 2.1.2). Because this stratification was not done proportionally to the distribution observed in the general Belgian population, some age groups are underrepresented among the participants (e.g., 18-39 years and 40-64 years), while others are overrepresented (e.g., 3-9 years and 10-17 years) (Table 3). As with the geographical distribution, these differences were taken into account in the calculation of the weighting factors in order to restore the representativeness of our sample (see Section 2.7.1). Concerning the distribution by sex, we can see in Table 3 that the participant sample is close to the reference Belgian population.

Table 3 | Distribution of the Belgian reference population and the participant sample by age and sex, National Food Consumption Survey 2022-2023, Belgium

Age	Sex	Percentage (%) in the Belgian population*	Percentage (%) in the sample of participants**
3-9 years	Girls	3.7	11.2
	Boys	3.9	10.9
10-17 years	Girls	4.7	12.0
	Boys	4.9	12.1
18-39 years	Women	14.0	8.6
	Men	14.1	7.9
40-64 years	Women	16.8	8.3
	Men	16.9	8.2
65+ years	Women	11.5	10.6
	Men	9.3	10.4
Total	Women	50.8	50.6
	Men	49.2	49.4

* Belgian population aged 3 years and above, at 1st January 2022.

** including the additional sample in the Brussels-Capital Region.

2.6.3. Composition by education level

The level of education is an indicator reflecting the socio-economic level of the participants. Because our sample includes children and adolescents who have not yet completed their studies, we considered the highest diploma obtained at the level of the household. Table 4 shows that our sample has globally a higher education level than that observed in the Belgian population: 57% of our sample has a higher education degree while this percentage is 43% in the Belgian population. As with the geographical and age-sex distribution, these differences were taken into account in the calculation of the weighting factors in order to restore the representativeness of our sample (see Section 2.7.1).

Table 4 | Distribution of the Belgian reference population and the participant sample by education level, National Food Consumption Survey 2022-2023, Belgium

Education level	Percentage (%) in the Belgian population*	Percentage (%) in the total number of interviews**
Low secondary education and lower	18.6	15.2
Upper secondary and post-secondary education	33.2	24.9
Higher education	42.6	56.6
Not available	5.7	3.3

* Belgian population aged 3 years and above, at 1st January 2022.

** including the additional sample in the Brussels-Capital Region.

2.6.4. Composition by household type and size

Almost half of the respondents (48.1%) live in households with four or more members. The distribution of households by size is relatively similar in Flanders, Wallonia and Brussels, with a majority of households of four or more members (Table 5). This distribution differs slightly from that observed in the Belgian population in 2021, where 15.6% of private households consisted of one person, 27.9% of two persons, 18.4% of three persons and 37.9% of four or more persons (46).

Table 5 | Distribution of the participant sample by household size, National Food Consumption Survey 2022-2023, Belgium

Household size in the participant sample	Flanders (%)	Brussels* (%)	Wallonia (%)	Total* (%)
One person	11.1	15.9	13.0	13.0
Two persons	25.2	18.6	25.4	23.3
Three persons	14.5	16.7	14.5	15.1
Four persons and more	49.0	47.8	47.0	48.1
Unknown	0.3	1.0	0.1	0.5

* Including the additional sample in the Brussels-Capital Region.

In terms of household type, half of the respondents (52.2%) belong to a “couple with children” household, while 18.2% belong to a “couple without children” household, 10.3% are single, 9.8% come from a single-parent family and 9.1% belong to another type of household (Table 6). This distribution differs from that observed in the Belgian population in 2021 where the proportion of single households is higher (35.0%) and the proportion of couples with children is lower (26.9%), compared to our sample (46). The proportions of single-parent family (9.8%) and couples without children (25.4%) in the Belgian population in 2021 are quite close from those observed in our sample (46). Differences observed can in part be attributed to the oversampling of some age-groups (e.g., children) in the study.

Table 6 | Distribution of the participant sample by household type, National Food Consumption Survey 2022-2023, Belgium

Household type in the participant sample	Flanders (%)	Brussels* (%)	Wallonia (%)	Total* (%)
Single	8.4	14.1	9.2	10.3
Single-parent with children	8.4	12.5	9.0	9.8
Couple without children	21.1	12.2	20.3	18.2
Couple with children	55.3	47.8	52.0	52.2
Other	6.6	12.9	9.2	9.1
Unknown	0.2	0.5	0.5	0.4

* Including the additional sample in the Brussels-Capital Region.

2.6.5. Composition by nationality

The majority (88.0%) of the participants is of Belgian nationality. Eight percent of the respondents are not Belgian but have the European Union citizenship, and 4.0% of the respondents are not Belgian and also do not have European Union citizenship. A similar distribution is observed in Wallonia and in Flanders. By contrast, in Brussels, the proportion of non-Belgian participants is the highest, with 26.0% of individuals not having a Belgian nationality (Table 7).

The distribution observed in our participant sample is similar to that observed at the Belgian level. Indeed, in 2021, 12.4% of the population residing in Belgium was not Belgian: 8.2% had the nationality of another European Union country and 4.2% had the nationality of a non-EU country (47).

Table 7 | Distribution of the participant sample by nationality, National Food Consumption Survey 2022-2023, Belgium

Nationality in the participant sample	Flanders (%)	Brussels* (%)	Wallonia (%)	Total* (%)
Belgian	94.8	73.4	93.1	88.0
Non-Belgian, European (EU)	2.9	17.1	5.4	7.8
Non-Belgian, non-European	2.3	8.9	1.3	4.0
Unknown	0.0	0.6	0.2	0.2

* Including the additional sample in the Brussels-Capital Region.

2.7. PRESENTATION OF THE RESULTS

2.7.1. Weighting factors

The results were weighted in order to better represent the target population, i.e., the Belgian population aged 3 years and older. Indeed, the participant sample differs from the target population due to lower or higher response rates in certain subgroups of the population (e.g., persons with low education level, persons living in the province of Liège) and due to the oversampling of some subgroups of the population (e.g., persons living in Brussels, children, adolescents).

A weighting factor was calculated for each respondent. Calculating these coefficients involves taking into account the distribution of the sample according to the province, sex, age, education level and

season during which the interview was conducted. Taking the season allows to account for the possible influence of seasonal variations.

In the first stage, the inverse of the probability of selection of the individual, i.e., the ratio between the number of interviews in each “province x age group x sex x education level” stratum and the size of the reference population in that stratum, was calculated. This first coefficient was then multiplied by a second coefficient taking into account the seasonal distribution of the interviews in order to provide the final individual weighting factors. Because the range of the weighting factors was wide, we shrank them so that the ratio between the highest factor and the lowest factor does not exceed 40. Table 8 describes the distribution of the individual weighting factors used in the survey.

Table 8 | Mean, extreme values and percentiles of individual weighting factors, National Food Consumption Survey 2022-2023, Belgium

Distribution	Weighting factors
Mean	10.4
Minimum – maximum	1.0 – 40.0
P25	3.4
Median	6.4
P75	13.8

2.7.2. Presentation of the results

The results are published in successive wave:

- The first wave will include results about the weight status and the weight behaviours of the population, as well as about the food habits and determinant of food choices.
- The second wave will include results about the physical activity and the sedentary behaviours of the population.
- The third wave will include results about the consumption of foods of the population.

The fourth wave will include results about the intake of energy, macro- and micronutrients of the population. In each step, the results will be published on our website and summarized in an infographic report. The analysis of the data and the calculation of indicators are carried out by module, i.e., according to different specific research themes.

Separate reports will also present results for the Brussels sample, the German community sample, and for supplement intake of the population.

2.7.2.1. Standardisation

Indicators are expressed as proportions (for binary and categorical indicators) or means (for continuous indicators). The crude proportions correspond to the actual proportion of people belonging to a certain category in the population studied; they are weighted percentages. Similarly, the crude mean expresses the weighted mean value of the indicator in the population. This information is descriptive and must be interpreted with caution when comparing different population subgroups (for example, men and women).

To compare correctly several subgroups of the population (for example, according to the region), it is necessary to eliminate the potential effect of the distribution of the population by age and/or sex on the results. For example, if the mean value of an indicator is higher for people living in Wallonia than for those living in Flanders, this difference may be related to a higher proportion of a certain age group or one of the two sexes in Wallonia, and not to a “direct effect” of the region of residence. Adjusted proportions or means have therefore been calculated (using linear regressions with sex and age as covariates) to take into account possible differences in the distribution by age and sex between the groups studied.

2.7.2.2. Statistical inference: are difference observed real?

Proportions and means are sometimes presented with a confidence interval (represented by errors bars in the graphs). The confidence interval indicates the limits within which the parameter to be estimated has a high probability (95%) of being found if the estimations are repeated. It therefore indicates the accuracy of the result. When there is no overlap in the confidence intervals between two groups (men and women, for example), it is reasonable to conclude that the difference between these two groups is very likely to be a real difference in the population. By contrast, when there is overlap, no direct conclusion can easily be drawn and additional analyses must be carried out to determine the extent to which the results differ statistically. In that case, multivariate regression were performed (using StataSE 16 software) and p-values calculated. In the absence of any statistical evidence of difference (p-values usually >0.1), the comparison was not or only briefly mentioned in the text.

2.7.2.3. Presentation of the results by category

For each thematic, the results are described at the level of the general population, but also according to different categories. The results are generally first described by **sex** (males and females) and/or by **age group** (3-9 years, 10-17 years, 18-39 years, 40-64 years, 65 years and above).

The results are then presented according to the highest **education level** in the respondent's household. This indicator takes into account the highest level of education between: (i) the respondent and his/her partner for adults (aged 18 to 64 years); and (ii) the father and mother (or, if applicable, the guardian) for children and adolescents (aged 3 to 17 years). The different levels of education of the respondents were aggregated into three categories:

- “Secondary school or lower”: this category includes people without a diploma, those with a primary diploma and those with a secondary diploma (lower secondary, upper secondary and post-secondary);
- “Short-type higher education”: this category includes people with a short-type non-university education and those with an academic bachelor's degree;
- “Long-type higher education”: this third category includes people with a long-type non-university diploma, those with a master's degree or equivalent and those with a doctorate.

The education level is known for the majority of participants; however, it could not be calculated for 16 participants due to missing data. In addition, 14 participants had a level of education classified as ‘other’, i.e., that could not be linked with certainty to the levels of education considered.

Another comparison concerns the **region** in which the respondents live: Flanders, Brussels and Wallonia. Brussels was included in the regional comparison only for the indicators based on data collected in both the national sample and the additional sample in Brussels. For indicators based on data collected in the national sample only, Brussels was not included because the number of respondents of the national sample living in Brussels was too small (n=163) to provide a relevant comparison (i.e., the uncertainty of the results being too wide).

Finally, where possible, a comparison between **years** was performed: the results of the current survey were compared with those of the 2004 and 2014-2015 surveys. This comparison was performed only for indicators based on data that were also collected during the previous surveys. When the comparison includes the 2004 survey, only the persons aged between 15 years and above are considered since they constitute the common age range between both surveys. When the comparison includes the 2014-2015 survey, only the persons aged between 3 and 64 years are considered. Finally, when both previous surveys are used, only the persons aged between 15 and 64 years are considered. Surveys weights of the 2004 and 2014-2015 survey were re-calculated to ensure valid comparison over time.

Appendix

Table A1 – Survey topics covered in questionnaires for the main national sample, including mode of collection and age groups targeted

Modules	Mode of collection			Age group			
	CAPI ¹	Self-administered	Measurement	Children	Adolescents	Adults	Older adults
Background information							
Participant and household information	X			X ²	X	X	X
Occupation	X			X ²	X ²	X	X
Education	X			X ²	X ²	X	X
Income	X			X ²	X	X	X
Food security	X			X ²	X	X	X
Breastfeeding/pregnancy	X			X ²	X	X	
Smoking		X		X ²	X	X	X
Tooth decay	X						X
Food consumption							
24h dietary recalls	X ³			X	X	X	X
FPQ ⁴		X		X	X	X	X
Eating habits and food environment							
Breakfast frequency	X			X	X	X	X
Involvement in meal preparation	X			X	X		
Watching TV while dinner	X			X	X	X	X
Home environment	X			X			
Food literacy	X					X	X
Perceived food environment	X					X	X
Use of apps for food shopping	X					X	X
Influence of labels and Nutri-Score	X					X	X
Marketing to children	X			X			
Diet and weight management							
Attitude towards weight		X			X	X	X
Means of weight management		X			X	X	X

¹ Computer-assisted personal interview

² Parental

³ With the GloboDiet® software

⁴ FPQ = Food Propensity Questionnaire (the questions on food supplements will be in the CAPI)

Modules	Mode of collection			Age group			
	CAPI ¹	Self-administered	Measurement	Children	Adolescents	Adults	Older adults
Weight management motivations		X			X	X	X
Eating disorders and undernutrition							
SCOFF		X			X	X	
Eating attitude test 7		X			X		
Mini Nutritional Assessment Short form		X					X
Attitudes towards food policies							
Actions expected from the government	X					X	X
Physical activity (PA) and sedentary behaviours (SB)							
Accelerometers			X	X	X		
Self-reported PA	X			X	X	X	X
Context of PA	X			X	X	X	X
Self-reported SB	X			X	X	X	X
Context of SB	X			X	X	X	X
Anthropometry							
Height	X ⁵		X	X	X	X	X
Weight	X ⁵		X	X	X	X	X
Waist circumference			X	X	X	X	X
Health status							
Minimum European Health Module		X		X	X	X	X
Diagnosed with a condition (e.g., diabetes, allergy)		X		X	X	X	X
Mental Health: Hopkins Symptom Checklist-5		X			X	X	X
Special diet	X ⁵			X	X	X	X
Food safety							
Home cooking practices	X			Person responsible for food preparation in the household			
Food safety behaviours	X			Person responsible for food preparation in the household			

⁵ Self-reported during Globodiet® interview

Table A2 - Survey topics covered in questionnaires for the additional sample in Brussels and the German-speaking Community, including mode of collection and age groups targeted

Modules	Mode of collection			Age group			
	CAPI ¹	Self-administered	Measure	Children	Adolescents	Adults	Older adults
Background information							
Participant and household information	X			X ²	X	X	X
Occupation	X			X ²	X ²	X	X
Education	X			X ²	X ²	X	X
Income	X			X ²	X	X	X
Food security	X			X ²	X	X	X
Breastfeeding/pregnancy	X			X ²	X	X	
Smoking		X		X ²	X	X	X
Tooth decay	X						X
Food consumption							
FFQ ⁶	X			X	X	X	X
Eating habits and food environment							
Breakfast frequency	X			X	X	X	X
Involvement in meal preparation	X			X	X		
Watching TV during dinner	X			X	X	X	X
Home environment	X			X			
Food literacy	X					X	X
Perceived food environment	X					X	X
Use of apps for food shopping	X					X	X
Influence of labels and Nutri-Score	X					X	X
Marketing to children	X			X			
Diet and weight management							
Attitude towards weight		X			X	X	X
Means of weight management		X			X	X	X
Weight management motivations		X			X	X	X
Eating disorders and undernutrition							
SCOFF		X			X	X	
Eating attitude test 7		X			X		

⁶ FFQ = Food Frequency Questionnaire

Modules	Mode of collection			Age group			
	CAPI ¹	Self-administered	Measure	Children	Adolescents	Adults	Older adults
Mini Nutritional Assessment Short form		X					X
Attitudes towards food policies							
Actions expected from the government		X				X	X
Physical activity (PA) and sedentary behaviours (SB)							
Self-reported PA		X		X	X	X	X
Context of PA		X		X	X	X	X
Self-reported SB		X		X	X	X	X
Context of SB		X		X	X	X	X
Anthropometry							
Height			X	X	X	X	X
Weight			X	X	X	X	X
Waist circumference			X	X	X	X	X
Health status							
Minimum European Health Module		X		X	X	X	X
Diagnosed with a condition (e.g., diabetes, allergy)		X		X	X	X	X
Mental Health: Hopkins Symptom Checklist-5		X			X	X	X
Special diet		X		X	X	X	X

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