

EXTERNAL SCIENTIFIC REPORT



APPROVED: 23 November 2017

doi:10.2903/sp.efsa.2017.EN-1341

National Food, Nutrition and Physical Activity Survey of the Portuguese general population

Carla Lopes^{1,2}, Duarte Torres^{3,2}, Andreia Oliveira^{1,2}, Milton Severo^{1,2}, Sofia Guiomar^{4,5}, Violeta Alarcão⁵, Sofia Vilela², Elisabete Ramos^{1,2}, Sara Rodrigues^{3,2}, Luísa Oliveira⁴, Paulo Nicola⁵, Jorge Mota⁶, Pedro Teixeira⁷, Simão Soares⁸

¹ Faculty of Medicine, University of Porto, Portugal, ² EPIUnit, Institute of Public Health, University of Porto, Portugal, ³ Faculty of Nutrition and Food Sciences, University of Porto, Portugal, ⁴ National Health Institute Doutor Ricardo Jorge, Portugal, ⁵ Institute of Preventive Medicine and Public Health, Faculty of Medicine, University of Lisbon, Portugal, ⁶ CIAFEL, Faculty of Sports, University of Porto, Portugal, ⁷ Faculty of Human Kinetics, CIPER, University of Lisbon, Portugal, ⁸ SilicoLife, Lda, Portugal

Abstract

The National Food, Nutrition and Physical Activity Survey of the Portuguese general population aimed to collect nationwide and regional data on dietary intake and physical activity, and their relation with health determinants, namely socioeconomic factors. Results from this project were obtained from a representative sample of the Portuguese population, aged between three months to 84 years of age, selected from the National Health Registry, by multistage sampling (a sample size of 5068 individuals was estimated and 5811 participants with two dietary assessments were achieved). To accomplish the EFSA requirements, a minimum, of 260 individuals in each age group (130 by sex) was planned. Two face-to-face interviews were conducted at a health care centre or participant's home. Dietary intake was obtained by two non-consecutive days of food diaries for children (<10 years old) and two non-consecutive 24-hours recalls for the older age groups, with a time interval between 8 and 15 days, complemented with a Food Propensity Questionnaire. An electronic platform based on a client-server architecture was used to manage the field work and to assist the data collection. The Electronic Assessment Tool for 24-hours recall (eAT24) allowed the collection of dietary data by an Automated Multiple-Pass Method for 24-hours. This interview-based dietary assessment instrument allowed obtaining a very detailed description and quantification of foods, recipes, and food supplements consumed in the course of the preceding day, and it had several adaptations, described in detail in this report. The survey outcomes support solid evidence-based information covering all age groups of the population, using harmonized methodologies at the European level, and will contribute to develop a national infrastructure for monitoring progress of specific targets supporting national and European policies and future interventions on diet, physical activity and food safety.

© European Food Safety Authority, 2017

Key words: Food consumption, nutritional intake, physical activity, food insecurity, food safety, general population, national survey

Question number: EFSA-Q-2012-00770

Correspondence: DATA.Admin@efsa.europa.eu

Disclaimer: The present document has been produced and adopted by the bodies identified above as authors. This task has been carried out exclusively by the authors in the context of a contract between the European Food Safety Authority and the authors, awarded following a tender procedure. The present document is published complying with the transparency principle to which the Authority is subject. It may not be considered as an output adopted by the Authority. The European Food Safety Authority reserves its rights, view and position as regards the issues addressed and the conclusions reached in the present document, without prejudice to the rights of the authors.

Acknowledgements: This Survey received funding from the EEA Grants Program, Public Health Initiatives (PT06 - 000088SI3). The project had institutional support from the General Directorate of Health (DGS), the Regional Health Administration Departments, and the Central Administration of the Health System (ACSS). The researchers acknowledge all the institutions and persons involved in all phases of the Survey, as well as participants.

Suggested citation: University of Porto, National Health Institute Doutor Ricardo Jorge, University of Lisbon, SilicoLife Lda, Lopes C, Torres D, Oliveira A, Severo M, Guiomar S, Alarcão V, Vilela S, Ramos E, Rodrigues S, Oliveira L, Nicola P, Mota J, Teixeira P, Soares S. National Food, Nutrition and Physical Activity Survey of the Portuguese general population. EFSA supporting publication 2017:EN-1341. 37 pp. doi:10.2903/sp.efsa.2017.EN-1341

ISSN: 2397-8325

© European Food Safety Authority, 2017

Reproduction is authorised provided the source is acknowledged.

Summary

The National Food, Nutrition and Physical Activity Survey of the Portuguese general population (IAN-AF, 2015-2016) aimed to collect nationwide and regional data on dietary intake and physical activity, and their relation with health determinants, namely socioeconomic factors. It had as specific objectives: 1) To assess food consumption of the Portuguese population, including: a) foods, nutrients, food supplements and other food-related risk behaviours; b) food contaminants and biological hazards (food safety); c) food insecurity; 2) To assess physical activity (PA) levels, including sedentary behaviours, sports/leisure-time physical activities and active choices in daily living; 3) To characterize dietary, PA and anthropometric dimensions by region, socioeconomic conditions and other health-related determinants.

The sample was selected by multistage sampling, using as frame the National Health Registry. The target sample was the Portuguese population aged between three months and 84 years of age. A random selection of Primary Health Units in each region, stratified by the seven Statistical Geographic Units - NUTS II (North, Centre, Lisbon Metropolitan Area, Alentejo, Algarve, Madeira and Azores) was performed. In each region, the sampling was weighted taking into account the number of individuals in each Primary Health Unit. By assuming a maximum difference of 8% of one standard-deviation with a confidence level of 95%, the sample size for each region was estimated in 603 individuals (total of 5068 individuals in the seven regions). To accomplish EFSA requirements, an oversampling of children <1 year (3-11 months) and 1-2 years was performed to obtain a minimum of 260 individuals in each age group (130 by sex). The final sample included 5811 participants who completed two dietary assessments. A total of 6553 participants attended to the first interview, from whom 6429 completed at least one dietary assessment. An oversampling of pregnant women was also performed (n=184).

Data was collected by trained fieldworkers using Computer-assisted personal interviewing (CAPI). The field work was run during 12 months to minimize seasonal variability (from October 2015 to September 2016). Two face-to-face interviews were conducted, performed at participant's home or at a health care centre (according to participant's preference). The national survey included the evaluation of the following dimensions: 1) dietary and nutritional intake (24-hours recalls, food diaries, Food Propensity Questionnaire (FPQ)); 2) eating habits and behaviours; 3) food supplements' use; 4) food safety and insecurity; 5) physical activity levels (International Physical Activity Questionnaire (IPAQ), diaries); 6) sedentary behaviours; 7) socio-demographics; 8) general health data; 9) anthropometrics.

Dietary intake was obtained by two non-consecutive days of food diaries for children (<10 years old), followed by a face-to-face interview to parents or caregivers, and two non-consecutive 24-hours recalls for the older age groups (with an interval between 8 and 15 days), complemented with a FPQ.

Data from the 24-hours recall were validated against urinary biomarkers for a sub-sample of adults (n=94). A 24-hours urinary sample was collected during the day before the second interview. The urinary concentration of sodium, potassium, iodine and total nitrogen was assessed.

An electronic platform ("You eAT&Move") based on a client-server architecture was used to manage the field work and common files (at server) and to assist data collection, at client level. The "You eAT&Move" e-platform includes three main components (modules): a) "You" module (including socio-demographics, anthropometrics (measurement of weight height/length, body circumferences), general health data, diet by a FPQ and food insecurity); b) "eAT24" module for collection of consumption data by a 24-hours recall (or food diaries), using food pictures for portion size estimation, synchronised with nutritional composition data of foods and recipes and considering the FoodEx2 food classification system; c) "Move" module for data collection on physical activity (including the IPAQ, the Activity Choice Index (ACI) and physical activity diaries), some of which were synchronised with metabolic equivalents data associated with each type of physical activity.

The eAT24 software (Electronic Assessment Tool for 24-hours recall) allows obtaining a very detailed description and quantification of foods, recipes, and food supplements consumed in the course of the preceding day by an Automated Multiple-Pass Method for 24-hours. The software allows subsequent conversion of foods into nutrients, using by default the Portuguese food composition table, adapted during field work. The eAT24 software uses several quantification methods (e.g. household measures and food photos series). The eAT24 methodology requires the description of consumed foods during the dietary interview through various facets and respective descriptors (based on the FoodEx2 classification). An electronic picture book for the quantification of food portions including 186 food photos series with six portions for each food/recipe item and 11 household measures photo series was also produced and included in the eAT24 software. The eAT24 software was adapted to follow the standardised food classification and description system FoodEx2.

Findings from this survey allowed having national updated knowledge on the distribution of diet, physical activity and other health-related risks, according to socio-demographics of participants (such as sex, age, geographical region and education).

The project expects to contribute to the development of national and European evidence-based policies which translate research into effective nutrition and health strategies, sustainable across time.

Table of contents

Abstract.....	1
Summary.....	3
1. Introduction and objectives	6
1.1. Background and terms of references as provided by the requestor.....	6
1.2. Survey planning and management	7
2. Description of the protocol of the survey	8
2.1. Study population and exclusion criteria.....	8
2.2. Sampling frame	8
2.3. Sampling method and design.....	9
2.4. Sample size	9
2.5. Strategy to achieve an adequate response rate and the initial sampling size	18
2.6. Legal and ethical aspects.....	19
3.1. Food propensity questionnaire	19
3.2. Dietary recall and food records	20
3.2.1. Food description	22
3.2.2. Determination of portion sizes	24
3.3. Other information	26
3.3.1. Questionnaires.....	26
3.3.2. Measurement of body weight and height	29
3.3.3. Food supplements.....	29
4.1. Selecting the examination site	29
4.2. Content and organization of the study visits	30
4.2.1. First contact	30
4.2.2. First interview	30
4.2.3. Second interview.....	30
4.2.4. Interviewing and checking of questionnaires.....	31
4.3. Recruitment and training of the staff	31
4.3.1. Selection of the fieldwork staff.....	31
4.3.2. Training.....	31
5. Quality assurance.....	31
6. Data management	32
7. Dissemination and publicity	33
8. Special issues/challenges.....	33
Conclusions.....	34
References.....	35
Abbreviations	37

1. Introduction and objectives

1.1. Background and terms of references as provided by the requestor

Access to uniform food consumption data across the EU Member States is fundamental for several functions of EFSA, European authorities and other bodies and stakeholders. In addition to food safety monitoring of existing hazards and evaluation of emerging risks, standardised food consumption data will be very useful in establishing new and updating existing legislation on the safety of foods.

A long term objective of EFSA is the organisation of a fully harmonised pan-European Food Consumption Survey, this project is called "What's on the Menu in Europe?" (EU Menu). The EU Menu survey is planned to be carried out in 2013-2018 whereas planning, harmonisation of protocols and implementation and piloting of methods have already started in 2010 for the different target population groups.

In October 2009, the EFSA Expert Group on Food Consumption Data (EGFCD) endorsed the Guidance of EFSA on "General principles for the collection of national food consumption data in the view of a pan-European dietary survey"¹ (EFSA, 2009). The main objective of this Guidance is to recommend general principles for the collection of dietary information that can be used to calculate exposure to all possible biological agents and chemical substances considered by EFSA's Scientific Panels as well as estimating intake of nutrients and vitamins.

In January 2010, EFSA started the Article 36 project (CFP/EFSA/DCM/2009/02) "Pilot study for the Assessment of Nutrient intake and food Consumption Among Kids in Europe" (PANCAKE) (Ocké et al. 2012), coordinated by RIVM (The Netherlands) to develop and test tools and procedures for the collection of individual food consumption data for infants, toddlers and other children up to 10 years of age.

In January 2011, EFSA started the Article 36 project (CFP/EFSA/DCM/2010/02) "Pilot study in the view of a Pan-European dietary survey – Adolescents, adults and elderly" (PANEU) (Ambrus et al, 2013), coordinated by the Hungarian Food Safety Office to develop and test similar tools and protocols for the different adult population groups.

The Guidance of EFSA on "General principles for the collection of national food consumption data in the view of a pan-European dietary survey" was updated in 2014 with recommendations from the pilot studies.

Further, since December 2010, EFSA collaborates with the International Agency for Research on Cancer (IARC) through a negotiated procedure contract (NP/EFSA/DATEX/2010/01) in order to get the EPIC-SOFT dietary software and related interview and data management tools and databases developed and adapted according to the needs of EFSA and to ensure that this software can be used by EU Member States for their dietary surveys (EU Menu) (IARC, 2013).

The first series of support to the national dietary surveys was provided by means of the call for tender CFT/DCM/2011/02. Two applicants (from France and Estonia) were awarded a contract in October 2011.

The proposed call for tenders is aimed at supporting at least three (up to six) EU Member States, which are having the governmental mandate to carry out a national dietary survey in the period from 2012 to 2015. Resources will be made available to support the adaptation of the methodology used in these studies to comply, as much as possible, with the general principles proposed in the above mentioned EFSA Guidance. The dietary data collected through the activity should be available to EFSA's scientific activities without restriction for its use.

The objectives of the contract resulting from the present procurement procedure are as follows:

¹ The guidance of EFSA has been updated in December 2014 and is available as Guidance on the EU Menu Methodology at <http://www.efsa.europa.eu/en/efsajournal/pub/3944> (EFSA, 2014)

- objective 1: To adapt the methodology used in the national food consumption survey, as much as possible, according to the above mentioned EFSA Guidance document.
- objective 2: To provide the national food consumption and related data collected within the survey to EFSA in the format required by EFSA.

This contract was awarded by EFSA to:

Contractor: University of Porto - Faculty of Medicine (FMUP), Portugal

Contract title: Support to national dietary surveys in compliance with the EFSA Guidance on "General principles for the collection of national food consumption data in the view of a pan-European dietary survey"-second support

Contract number: CFT/EFSA/DCM/2012/01-CT03

1.2. Survey planning and management

A Consortium was established to run this project and included scientific experts from different institutions with knowhow on several specific areas needed to accomplish the activities described in this report. They are experts with previous experience in dietary and food safety assessment and in the collection and management of individual dietary and physical activity data surveys. Part of the team was involved in the European PANEU project (Ambrus et al, 2013), a pilot study to harmonize and standardize collection of reliable individual food consumption data. This experience together with the involvement in other European projects, such as EFCOSUM, HECTOR, ENHR, DAFNE and HabEat supported the ability of the team to perform this project with success.

The Consortium was composed by:

- Faculty of Medicine, University of Porto – FMUP (Promoter) (Carla Lopes, Milton Severo, Andreia Oliveira)
- EPIUnit – Institute of Public Health, University of Porto - ISPUP (Elisabete Ramos, Sofia Vilela)
- Faculty of Nutrition and Food Sciences, University of Porto - FCNAUP (Duarte Torres, Sara Rodrigues)
- National Institute of Health Doutor Ricardo Jorge (INSA), Ministry of Health (Sofia Guiomar, Luísa Oliveira)
- Institute of Preventive Medicine and Public Health, Faculty of Medicine, University of Lisbon, Portugal - FMUL (Paulo Nicola, Violeta Alarcão)
- Faculty of Sports, University of Porto - FADEUP (Jorge Mota)
- Faculty of Human Kinetics, University of Lisbon - FMHUL (Pedro Teixeira)
- SilicoLife (Simão Soares)

The project received funding from the EEA Grants Program, Public Health Initiatives (PT06 - 000088SI3), and had the institutional support from the General Directorate of Health (DGS), the Regional Health Administration Departments, and the Central Administration of the Health System (ACSS).

The Promoter, FMUP, coordinated all the process through the National field Coordinator (Andreia Oliveira) and Sub-coordinator (Violeta Alarcão) who were in close contact with the Coordinator of the project (Carla Lopes), the primary link between the partners, the staff and the stakeholders.

A project management office assisted the Promoter in the administration of the project and financial management issues. Each Regional field coordinator reported the field progress to the National field Coordinators. The Promoter was responsible for monitoring budgets and progress towards milestones and deliverables. Competencies were considered by sharing leadership with all partners and the risk

management was a shared task. Several actions were planned and the website was used to facilitate information exchange and promotion of synergies between project components.

Communication between the partners was promoted by several working meetings (face-to-face and online meetings). Decisions were made by the Consortium of the project. In case of equality of votes, the Coordinator had a deciding vote. In-between project meetings, information was disseminated by email and using an intra-net system.

This project had as International Consultants:

- Sonja Nicholson, NDNS Coordinator, MRC Human Nutrition Research, UK
- Marga Ocké, National Institute for Public Health and the Environment (RIVM), The Netherlands
- Lene Andersen, Faculty of Medicine, University of Oslo, Norway

2. Description of the protocol of the survey

2.1. Study population and exclusion criteria

The study population was a probabilistic sample of the general (non-institutionalized) Portuguese population from the National Health Registry aged between three months and 84 years of age.

The following exclusion criteria were considered:

- Individuals living in collective residences/institutions (e.g. elderly in retirement homes or individuals in hospitals, at prisons or military barracks);
- Individuals living in Portugal for less than 1 year (non-applicable to infants);
- Non-Portuguese speakers;
- Individuals with diminished physical and/or cognitive abilities that hamper participation (e.g. blind, deaf, with diagnosed dementias);
- Individuals that passed away in the period between the extraction of the data and the selection of the sample.

Individuals with no established contact after all planned attempts (maximum of six by contact number in different daytimes and day hours), were considered in the group of unknown eligibility (unresolved individuals).

Eligible individuals not participating in the study were the ones that refused to participate, those without availability for the two interviews during the evaluation period and those who missed appointments.

For individuals belonging to the elderly age group (≥ 65 y old), a screening of cognitive impairment was performed by using the Mini-Mental State Examination test (Folstein et al, 1975), with a final maximum scale of 30 points corresponding to a better cognitive functioning. The classification of cognitive impairment was performed by using the scale's score and education level (Creavin et al, 2016) (Guerreiro et al, 1994): illiterate and ≤ 15 points; 1-11 years of education and ≤ 22 points; ≥ 11 years of education and ≤ 27 points. For these individuals only few socio-demographic and anthropometrics information were collected.

2.2. Sampling frame

The sampling frame used for the Portuguese EU Menu survey was the National Health Registry. The sampling was based on the list of all Primary Health Care Units by the seven Statistical Geographic

Units of Portugal - NUTS II (North, Centre, Lisbon Metropolitan Area, Alentejo, Algarve, Madeira and Azores).

With this sampling frame, we expected to reach the Portuguese general population, since all individuals must be registered at the National Health System. Since we selected and contacted subjects registered in the Health System (and not only users of the Health Care Units), the participation was expected to be independent of the regular use of the Health System. For children, in particular, almost all (if not all) infants and toddlers are registered and actively visit the Health Care Units because they are included in the national vaccination plan and they benefit from free vaccines in the first years of life; so by using the National Health System as sampling frame we are confident that it was a good way of assuring representativeness at these age frames (the vaccination coverage is >95%).

2.3. Sampling method and design

The sampling was performed by multistage sampling, following these steps:

- Stratification by the seven Statistical Geographic Units - NUTS II (North, Centre, Lisbon Metropolitan Area, Alentejo, Algarve, Madeira and Azores).
- Random selection of Primary Health Care Units in each region.
- Random selection of registered individuals in each Primary Health Care Unit, according to sex and age groups.

At the five Geographic Units of Mainland, the sampling was done in connection with the national Central Administration of the Health System (ACSS). In the islands (Madeira and Azores), the sampling was performed in connection with the Regional Departments of Health.

Since the Survey lasted one year, consecutive recruitment waves were considered in order to use the most updated versions of the National Health Registry lists (three recruitment waves for infants and toddlers and two recruitment waves for the remaining age groups).

2.4. Sample size

The Survey was conducted in the general population of Portugal, covering all six age groups (infants, toddlers, other children, adolescents, adults and the elderly).

The sample size was estimated by assuming a mean population energy intake of 2000 kcal/day (standard deviation=500) and an effect size of 8%, with a confidence level of 95%. The sample size for each geographical region was estimated in 603 individuals (a total of 4221 individuals in the seven regions).

To estimate the study design effect, the following information was taken into consideration: a) a coefficient variation of cluster sizes of 0.4; b) data from cluster-based studies with primary health care setting in Portugal, measuring the dependency effect of exposures such as body mass index or energy intake (mean intra-cluster correlation coefficient of 0.58%); c) a mean number of participants reachable in each Primary Health Care Unit, depending on the field work management (30 individuals were estimated to be evaluated during four weeks). Considering these data, a design effect of 1.20 (an increase of 20% of the sample size) was estimated.

The design effect was defined by Kish (Kish Leslie, 1965) as the ratio of a variance of an estimate in a complex sample to the variance of the same estimate in a simple random sample, which in simple words means that to obtain the same power of a simple random sampling we need an increase of 20% of the sample size.

By assuming a design effect of 1.20, 724 individuals should have been assessed in each region, resulting in a total sample of 5068 individuals in the seven regions. Thus, taking into account the

distribution of the Portuguese population, according to the CENSUS 2011 (Statistics Portugal, 2011), the sample size required to have representativeness at the national level was of 5068 individuals: 935 children and adolescents (0-17 years), 3262 adults (18-64 years) and 871 elderly (65-84 years). In Table 1, the estimated sample size by each age group and sex, taking into account the Portuguese population distribution, is described.

Table 1: Estimation of the sample size by each age group and sex, considering the distribution of the Portuguese general population

	Age groups (years)								Total
	< 1	1-2	3-9	10-17	18-34	35-64	65-74	75-84	
Total	47	94	353	440	1101	2161	514	357	5068
Male	24	48	181	225	547	1038	232	144	2439
Female	23	46	172	215	554	1123	282	213	2629

To accomplish the EFSA requirements of including 260 individuals in each age group (130 per sex), an oversampling of children <1 year (3-11 months) (6 times the initial proportion) and 1-2 years (3 times the initial proportion) was considered, followed by a redistribution of the sample size for the other age groups. Table 2 presents the estimated sample size redistribution according to sex and age groups.

Table 2: Estimation of the sample size by each age group and sex, considering the oversampling of younger age groups.

	Age groups (years)								Total
	< 1	1-2	3-9	10-17	18-34	35-64	65-74	75-84	
Total	269	266	339	422	1047	1978	457	324	5102
Male	136	136	174	214	523	957	205	130	2475
Female	133	130	165	208	524	1021	252	194	2627

In each Primary Health Care Unit, a fixed number of individuals by sex and age group was assumed.

An additional sample of pregnant women was also planned (n=200) using the same sampling frame, resulting in two to three pregnant women by each Primary Health Care Unit.

Considering a potential participation rate of 70% in the first visit and 70% in the second visit ($70\% \times 70\% = 49\%$), we expected 50% of non-response, individuals unreachable, incomplete questionnaires and drop-offs, thus 10204 ($\approx 5102 \times 2$) participants were estimated to be selected and contacted. After the pilot studies, a more conservative participation rate of 20% ($5102 \times 5 = 25510$) was assumed.

Final sample size

Assuming a one-month period for data collection in each Primary Health Care Unit, and the estimation of approximately 30 participants by each Unit, the number of Primary Health Care Units needed to be selected was 21 by region. This number was applied to the North, Centre and Lisbon regions, but due to logistic constraints related with the field work efficiency, and due to the low number of Primary Health Care Units in the other regions, in Alentejo and Algarve 12 Primary Health Care Units were selected, and in Madeira and Azores 6 Primary Health Care Units were selected. Figure 1 shows the spatial distribution of the Primary Health Care Units, randomly selected by the seven regions (NUTS II), weighted by the number of registered individuals.

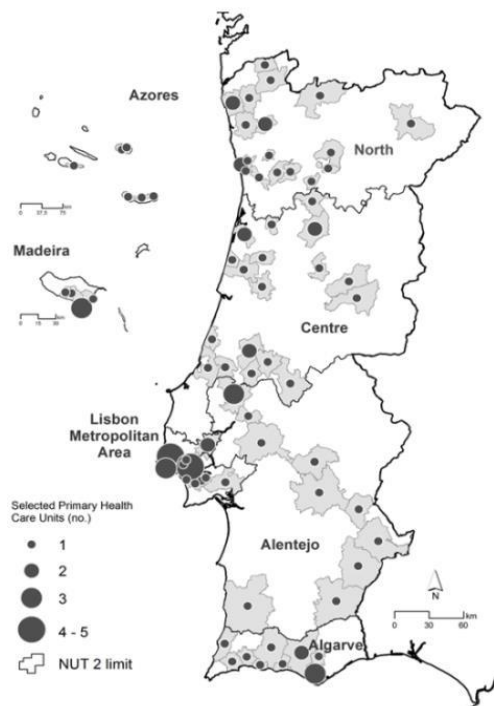


Figure 1: Spatial distribution of the Primary Health Care Units, randomly selected by the seven Statistical Geographic Units of Portugal (NUTS II), weighted by the number of registered individuals

The flowchart of participation in the IAN-AF is detailed in Figure 2. Of the 29183 selected individuals with valid contacts, 19635 were considered eligible for participation. Reasons for non-participation were refusal ($n = 10811$), absence at first interview, after they orally agreed to be interviewed ($n = 2152$), and incomplete data ($n = 119$). From those who refused, 5723 filled out a refusal questionnaire.

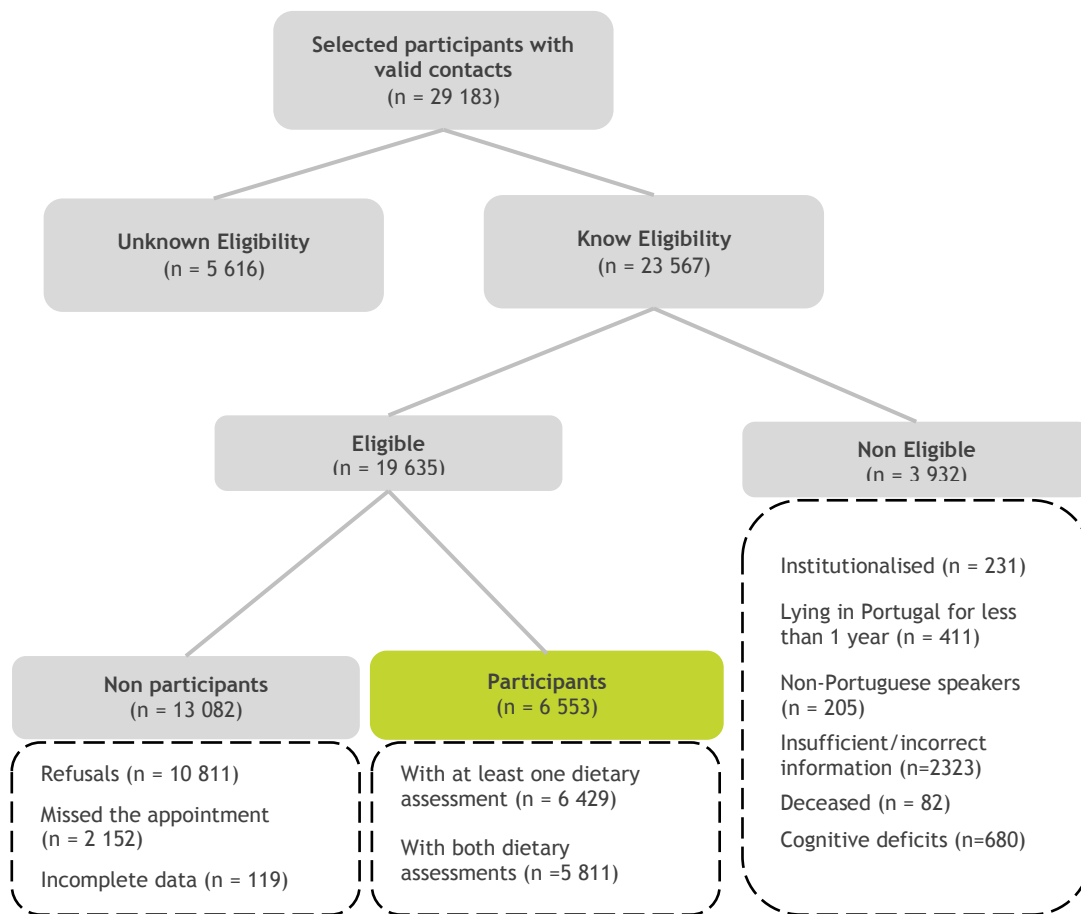


Figure 2: Flowchart of participation

The final sample size and participation rates are described in Table 3. The contact rate was 77.8%. A total of 6553 participants attended to the first interview, from whom 6429 completed at least one dietary assessment and 5811 complete both dietary assessments. The cooperation rate was 33.4% and 29.6%, respectively. The participation rate was 26.0% considering the first interview and 23.0% for the participants with two dietary assessments completed. The participation rates were higher in children and adolescents (approximately 40%) and much lower in the elderly (approximately 20%). An additional sample of 184 pregnant women was evaluated.

Table 4 presents the same information stratified by region (NUTS II). The participation rates were slightly lower in Lisbon Metropolitan Area and Alentejo regions.

Table 3: Final sample size by sex and age groups

	Total	< 1 year		1 - 2 years		3 - 9 years		10 - 17 years		18 - 34 years		35 - 64 years		65 - 74 years		75 - 84 years	
		♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
Selected Participants (n)	29183	304	319	792	824	827	823	952	987	3217	3666	5119	5719	1674	1459	1420	1081
Unknown Eligibility (n)	5616	60	65	164	174	164	165	197	163	784	901	893	1059	243	217	215	152
Known Eligibility (n)	23567	244	254	628	650	663	658	755	824	2433	2765	4226	4660	1431	1242	1205	929
Eligible (n)	19635	225	238	582	613	603	572	658	718	2038	2235	3687	3737	1200	1018	837	674
Non Eligible (n)	3932	19	16	46	37	60	86	97	106	395	530	539	923	231	224	368	255
Contact rate^(a)	77.8%	78.9%	78.5%	78.0%	77.9%	78.6%	77.6%	77.0%	81.5%	72.2%	71.3%	80.5%	77.9%	83.2%	82.4%	79.6%	81.6%
Participants at 1st interview (n)	6553	133	134	327	317	309	295	351	348	624	499	1257	1065	284	291	145	174
Cooperation rate^(b)	33.4%	59.1%	56.3%	56.2%	51.7%	51.2%	51.6%	53.3%	48.5%	30.6%	22.3%	34.1%	28.5%	23.7%	28.6%	17.3%	25.8%
Participation rate^(c)	26.0%	46.7%	44.2%	43.8%	40.3%	40.3%	40.0%	41.1%	39.5%	22.1%	15.9%	27.4%	22.2%	19.7%	23.6%	13.8%	21.1%
Participants with 2 dietary assessments (n)	5811	113	121	292	279	262	259	319	314	535	436	1139	992	247	262	111	130
Cooperation rate^(b)	29.6%	50.2%	50.8%	50.2%	45.5%	43.4%	45.3%	48.5%	43.7%	26.3%	19.5%	30.9%	26.5%	20.6%	25.7%	13.3%	19.3%
Participation rate^(c)	23.0%	39.6%	39.9%	39.1%	35.5%	34.2%	35.1%	37.3%	35.6%	19.0%	13.9%	24.9%	20.7%	17.1%	21.2%	10.6%	15.7%

(a): Contact Rate= eligible/eligible + unknown eligible individuals

(b): Cooperation Rate= participants/eligible individuals

(c): Participation Rate= participants/ (eligible + unknown eligible individuals)

Table 4: Final sample size and participation rates, by region

	Total	North	Centre	Lisbon	Alentejo	Algarve	Madeira	Azores
Selected Participants (n)	29 183	4434	4801	4299	3876	3739	3704	4330
Unknown Eligibility (n)	5616	994	1095	782	553	561	751	880
Known Eligibility (n)	23 567	3440	3706	3517	3323	3178	2953	3450
Eligible (n)	19 635	3016	3030	2927	2835	2630	2485	2712
Non Eligible (n)	3932	424	676	590	488	548	468	738
Contact rate^(a)	77.8%	75.2%	73.5%	78.9%	83.7%	82.4%	76.8%	75.5%
Participants at 1st interview (n)	6553	1134	1110	878	750	845	895	941
Cooperation rate^(b)	33.4%	37.6%	36.6%	30.0%	26.5%	32.1%	36.0%	34.7%
Participation rate^(c)	26.0%	28.3%	26.9%	23.7%	22.1%	26.5%	27.7%	26.2%
Participants with 2 dietary assessments (n)	5811	989	1014	809	670	766	779	784
Cooperation rate^(b)	29.6%	32.8%	33.5%	27.6%	23.6%	29.1%	31.3%	28.9%
Participation rate^(c)	23.0%	24.7%	24.6%	21.8%	19.8%	24.0%	24.1%	21.8%

(a): Contact Rate= eligible/eligible + unknown eligible individuals

(b): Cooperation Rate= participants/eligible individuals

(c): Participation Rate= participants/ (eligible + unknown eligible individuals)

Table 5 shows some characteristics of the participants in the IAN-AF. Approximately 23% are children under the age of 10, 11% are adolescents (10-17 years), 53% are adults (18-64 years) and 13% are elderly (65-84 years). Fifty two percent are females and 48% males. Most of the sample (45%) completed the 3rd cycle of basic education or secondary education, 27% have six or less years of schooling and 29% have completed higher education. Almost all individuals have Portuguese nationality. Approximately 61% are married or living in union and have a household consisting of three or four elements. More than 50% of the participants are paid workers and 12% are unemployed.

The characteristics of participants were compared with those individuals who refused to participate and who filled out a refusal questionnaire, where information on some important indicators, such as sex, age and region of residence (NUTS II) (Table 6) and frequency of consumption of fruit and vegetables, regular practice of leisure-time physical activity and nutritional status were available (Table 7).

Individuals who refuse to participate were older and less educated, although for variables representing the main areas of the survey (fruit and vegetables consumption, practice of regular leisure-time structured, and body mass index) the differences are of a small magnitude.

Table 5: Characteristics of participants in the Survey (IAN-AF)

	Participants at 1st interview		Participants with 2 dietary assessments	
	n	%	n	%
Sex	6553		5811	
Female	3430	52.3%	3018	51.9%
Male	3123	47.7%	2793	48.1%
Age group				
Children (<10 years)	1515	23.1%	1326	22.8%
Adolescents (10-17 years)	699	10.7%	633	10.9%
Adults (18-64 years)	3445	52.6%	3102	53.4%
Elderly (65-84 years)	894	13.6%	750	12.9%
Education level ^(b)				
≤9 years	1827	27.9%	1530	26.3%
10-12 years	2910	44.5%	2587	44.5%
>12 years	1784	27.3%	1675	28.8%
Do not know/answered	32	0.5%	19	0.3%
Nationality				
Portuguese	6456	98.5%	74	1.3%
Other	91	1.4%	5735	98.7%
Do not know/answered	6	0.1%	2	0.0%
Household members (number)				
1	528	8.1%	471	8.1%
2	1346	20.5%	1190	20.5%
3	1867	28.5%	1653	28.4%
4	1891	28.9%	1721	29.6%
5 or more	684	10.4%	574	9.9%
Do not know/answered	237	3.6%	202	3.5%
Marital status^(a)				
Not married	1101	25.4%	958	24.9%
Divorced	334	7.7%	300	7.8%
Widower	277	6.4%	237	6.2%
Married or living together	2623	60.5%	2354	61.1%
Do not know/answered	4	0.1%	3	0.1%
Working condition				
Worker for remuneration or profit	2347	54.2%	2119	55.0%
Unemployed	506	11.7%	444	11.5%
Other ^(c)	1474	34.0%	1286	33.4%
Do not know/answered	7	0.2%	3	0.1%
Household income ^(a)				
485 € or lower	437	10.1%	362	9.4%
485 - 970 €	1167	26.9%	1015	26.3%
971 - 1455 €	964	22.2%	875	22.7%
1456 - 1940 €	554	12.8%	514	13.3%
More than 1941 €	752	17.4%	708	18.4%
Don't know/answered	460	10.6%	378	9.8%

(a): Questionnaire applied only to participants aged ≥18; (b): a High educational level concluded was considered; (c): Includes retired, students, domestic, in military service, widow's pension, survivor's pension, unpaid leave and no retirement.

Table 6: Comparison of characteristics between participants and non-participants who filled out a refusal questionnaire

	Participants at 1st interview		Participants with 2 dietary assessments		Refusals	
	n	(%)	n	(%)	n	(%)
	6553		5811		5723	
Sex						
Female	3430	52.3%	3018	51.9%	2957	51.7%
Male	3123	47.7%	2793	48.1%	2766	48.3%
Age groups						
Children (<10 years)	1515	23.1%	1326	22.8%	626	10.9%
Adolescents (10-17 years)	699	10.7%	633	10.9%	272	4.8%
Adults (18-64 years)	3444	52.6%	3102	53.4%	3557	62.2%
Elderly (65-84 years)	895	13.7%	750	12.9%	1268	22.2%
Region						
North	1134	17.3%	989	17.0%	1106	19.3%
Centre	1110	16.9%	1014	17.4%	1218	21.3%
Lisbon Metropolitan Area	878	13.4%	809	13.9%	881	15.4%
Alentejo	750	11.4%	670	11.5%	788	13.8%
Algarve	845	12.9%	766	13.2%	792	13.8%
Madeira	895	13.7%	779	13.4%	225	3.9%
Azores	941	14.4%	784	13.5%	713	12.5%

To evaluate the representativeness of the participants in the universe of individuals living in Portugal, according to information from the National Statistics Institute (INE) (Statistics Portugal, 2012), and thus discuss the adequacy of the sampling frame based on those enrolled in the National Health Registry, some characteristics are compared between both groups (Table 7 & 8). After weighting, the final sample of the IAN-AF shows a similar distribution to the population living in Portugal, with the largest difference not exceeding three percentage points in relation to the distribution of the age group of the very elderly (75-84 years).

Table 7: Comparison of participant's characteristics with those who refused to participate and who filled out a refusal questionnaire

n (%)	Total		Children		Adolescents		Adults		Elderly	
	P	R	P	R	P	R	P	R	P	R
Education level										
≤9 years	1827 (27.9)	2276 (39.8)	101 (6.7)	65 (10.4)	143 (20.5)	80 (29.4)	906 (26.3)	1055 (29.7)	677 (75.7)	1076 (84.9)
10-12 years	2910 (44.4)	2342 (40.9)	753 (49.7)	312 (49.8)	345 (49.4)	132 (48.5)	1665 (48.3)	1769 (49.7)	147 (16.4)	129 (10.2)
>12 years	1784 (27.2)	1086 (19.0)	651 (43.0)	247 (39.5)	199 (28.5)	59 (21.7)	870 (25.3)	725 (20.4)	64 (7.2)	55 (4.3)
Do not know/answered	32 (0.5)	19 (0.3)	10 (0.7)	2 (0.3)	12 (1.7)	1 (0.4)	4 (0.1)	8 (0.2)	6 (0.7)	8 (0.6)
Nationality										
Portuguese	6456 (98.5)	5638 (98.5)	1501 (99.1)	621 (99.2)	693 (99.1)	269 (98.9)	3373 (97.9)	3485 (98)	889 (99.4)	1263 (99.6)
Other	92 (1.4)	85 (1.5)	9 (0.6)	5 (0.8)	6 (0.9)	3 (1.1)	72 (2.1)	72 (2.0)	5 (0.6)	5 (0.4)
Do not know/answered	5 (0.1)	0 (0.0)	5 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Working condition										
Worker for remuneration or profit	2347 (54.1)	2727 (56.5)	-	-	-	-	2314 (67.2)	2653 (74.6)	33 (3.7)	74 (5.8)
Unemployed	506 (11.7)	387 (8.0)	-	-	-	-	500 (14.5)	369 (10.4)	6 (0.7)	18 (1.4)
Other	1481 (34.1)	1696 (35.2)	-	-	-	-	626 (18.2)	525 (14.8)	855 (95.6)	1171 (92.4)
Do not know/answered	5 (0.1)	15 (0.3)					5 (0.1)	10 (0.3)	0 (0.0)	5 (0.4)
Diseases that require regular medical care										
No	4359 (66.5)	3934 (68.7)	1321 (87.2)	559 (89.3)	574 (82.1)	233 (85.7)	2240 (65)	2709 (76.2)	224 (25.1)	433 (34.1)
Yes	2100 (32.0)	1772 (31.0)	188 (12.4)	67 (10.7)	125 (17.9)	39 (14.3)	1204 (34.9)	837 (23.5)	583 (65.2)	829 (65.4)
Do not know/answered	94 (1.4)	17 (0.3)	6 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)	11 (0.3)	87 (9.7)	6 (0.5)
Practice of regular leisure-time structured physical activity^(a)										
No	3150 (55.8)	3550 (66.5)	227 (37.6)	118 (49.2)	265 (37.9)	143 (52.6)	2094 (60.8)	2330 (65.5)	564 (63.1)	959 (75.6)
Yes	2188 (38.8)	1745 (32.7)	309 (51.2)	121 (50.4)	393 (56.2)	128 (47.1)	1264 (36.7)	1202 (33.8)	222 (24.8)	294 (23.2)
Don't know/answered	304 (5.4)	42 (0.8)	68 (11.3)	1 (0.4)	41 (5.9)	1 (0.4)	87 (2.5)	25 (0.7)	108 (12.1)	15 (1.2)
Fruit and vegetables consumption^(a)										
< 5 portions/day	4524 (80.2)	4314 (80.8)	407 (67.4)	164 (68.3)	627 (89.7)	232 (85.3)	2847 (82.6)	2942 (82.7)	643 (71.9)	976 (77.0)
≥ 5 portions/day	1022 (18.1)	994 (18.6)	191 (31.6)	75 (31.2)	72 (10.3)	39 (14.3)	595 (17.3)	598 (16.8)	164 (18.3)	282 (22.2)
Do not know/answered	96 (1.7)	29 (0.5)	6 (1.0)	1 (0.4)	0 (0.0)	1 (0.4)	3 (0.1)	17 (0.5)	87 (9.7)	10 (0.8)
Self-reported BMI^b										
Normal/underweight	2943 (44.9)	2464 (43.1)	1027 (67.8)	314 (50.2)	351 (50.2)	136 (50.0)	1386 (40.2)	1697 (47.7)	179 (20.0)	317 (25.0)
Overweight	1499 (22.9)	1666 (29.1)	105 (6.9)	42 (6.7)	93 (13.3)	41 (15.1)	1015 (29.5)	1144 (32.2)	286 (32.0)	439 (34.6)
Obesity	830 (12.7)	711 (12.4)	36 (2.4)	31 (5.0)	43 (6.2)	9 (3.3)	549 (15.9)	476 (13.4)	202 (22.6)	195 (15.4)
Not measured	1281 (19.5)	882 (15.4)	347 (22.9)	239 (38.2)	212 (30.3)	86 (31.6)	495 (14.4)	240 (6.7)	227 (25.4)	317 (25.0)

P: participants; R: refusals; BMI: body mass index

(a): Asked from 3 years

(b): Defined according to the World Health Organization criteria.

Table 8: Comparison of participants with the distribution of the population living in Portugal, according to information from the National Statistics Institute (INE)

	Participants with 2 dietary assessments (n=5811)		Weighted final sample		INE (n=10 327 847)		dif. (pp)
	n	%	n	%	n	%	
Sex							
Female	3018	51.9%	5 298 758	51.0%	5 356 650	51.9%	-0.8
Male	2793	48.1%	5 081 062	49.0%	4 971 197	48.1%	0.8
Age groups							
≤ 4 years	944	16.2%	321 860	3.1%	482 647	4.7%	-1.6
5 - 9 years	382	6.6%	452 528	4.4%	525 087	5.1%	-0.7
10 - 14 years	416	7.2%	553 751	5.3%	564 595	5.5%	-0.1
15 - 19 years	337	5.8%	568 595	5.5%	565 250	5.5%	0.0
20 - 24 years	272	4.7%	761 797	7.3%	582 065	5.6%	1.7
25 - 29 years	258	4.4%	530 682	5.1%	656 076	6.4%	-1.2
30 - 34 years	321	5.5%	689 045	6.6%	773 567	7.5%	-0.9
35 - 64 years	2131	36.7%	4 872 170	46.9%	4 402 827	42.6%	4.3
65 - 74 years	509	8.8%	1 179 671	11.4%	1 048 139	10.1%	1.2
75 - 84 years	241	4.1%	449 722	4.3%	727 594	7.0%	-2.7
Region (NUTS II)							
North	989	17.0%	3 779 536	36.4%	3 620 158	35.1%	1.4
Centre	1014	17.4%	2 172 730	20.9%	2 261 569	21.9%	-1.0
Lisbon Metropolitan Area	809	13.9%	2 771 555	26.7%	2 765 351	26.8%	-0.1
Alentejo	670	11.5%	670 588	6.5%	734 061	7.1%	-0.6
Algarve	766	13.2%	417 354	4.0%	439 827	4.3%	-0.2
Madeira	779	13.4%	291 488	2.8%	263 681	2.6%	0.3
Azores	784	13.5%	276 570	2.7%	243 200	2.4%	0.3

National Statistics Institute (INE). Population and Housing Census - Census 2011 (Statistics Portugal, 2012).
 dif. pp: difference in percentage points

2.5. Strategy to achieve an adequate response rate and the initial sampling size

Participants were contacted by telephone to check their willingness to participate. If individuals did not answer after four contact attempts (by each phone contact) in different days and hours, a phone message was sent informing the purpose of the contact. After another two contact attempts in different days and hours, the participant was considered as non-contactable. If an oral acceptance was provided, an invitation letter with participation details (overall project aims, time and place of interviews) was sent by post mail. If individuals refused to participate, a short refusal questionnaire was applied by phone.

The invitation letter included also the logos of the institutions involved, whose high reputation was expected to stimulate the participation.

Two face-to-face interviews were conducted, performed at participant's home or in the Health Care Centre (according to participant's preference). Although the reporting days were randomly selected, the participant had the opportunity to choose the best days and hour to be evaluated.

A short report with individual summary results was delivered to each participant, after the end of the second interview.

The project was publicised by several channels: web, media, posters in the Primary Health Care Units, etc. A website for the project was designed, available in Portuguese and English (www.ian-af.up.pt), where it can be found useful information about the project and its related activities. A special section with information for participants was developed and the contacts of the regional coordinators and institutions were available. Social networks were created, as well as posters and newsletters informing

participants and the general health community about the project. During the field work, the project was disseminated through local media identified in each geographical region.

2.6. Legal and ethical aspects

Ethical approval was obtained from the National Commission for Data Protection, the Ethical Committee of the Institute of Public Health of the University of Porto and from the Ethical Commissions of each one of the Regional Administrations of Health.

All participants were asked to provide their written informed consent for participation according to the Ethical Principles for Medical Research involving human subjects expressed in the Declaration of Helsinki and the national legislation. Written agreements from the parents were required for children and adolescents below 18 years old. Adolescents (10-17 years old) were also asked to sign the consent form together with their legal representative.

All documents with identification data were treated separately and stored in a different dataset. The recruitment team had temporary access to datasets with identification of potential participants. They had signed a document assuring the confidentiality of the information.

3. Dietary survey tools

An electronic platform ("You eAT&Move") based on a client-server architecture was used to manage the field work and common files, at server, and to collect data, at client level. The "You eAT&Move" e-platform includes three main components (modules): a) "You" module (including sociodemographics, anthropometrics, general health data, diet by a Food Propensity Questionnaire (FPQ) and food insecurity); b) "eAT24" module, which allowed the collection and description of food consumption data by a 24-hours recall (or food diaries), with food models for portion size estimation, synchronised with nutritional composition data of foods and recipes; c) "Move" module, which allowed the collection of physical activity (PA) data (including the International Physical Activity Questionnaire (IPAQ) questionnaire, the Activity Choice Index (ACI), sedentary behaviours and PA diaries, synchronised with metabolic equivalents data associated with each type of PA).

All the questionnaires are available (in Portuguese) at the website of the project: www.ian-af.up.pt.

3.1. Food propensity questionnaire

A FPQ was applied to participants to supplement the dietary data obtained by 24-hours recalls or food dairies (in children) in order to minimise problems with the day-to-day variation in intakes, which is present in single or few short-term measurements and affects the estimation of usual intake.

Following the protocols proposed by PANEU (Ambrus et al, 2013) and PANCAKE (Ocké et al, 2012) studies, a non-quantitative food frequency questionnaire was defined, including a general list of food/beverage groups supposedly common to the different European countries (e.g. bread, rice, pasta, potatoes, fruits, red and white meat, fish, milk, butter, coffee, tea, alcoholic beverages) and a list of country-specific foods and beverages important for risk assessment (e.g. certain types of vegetables, specific fresh or canned fish, certain types of cheeses).

The dimension of the list and the reference period of consumption were different by age group. Parents (or the main caregiver) of children from three up to nine years were asked to report the frequency of consumption of 45 food items in the last month. For adolescents and adults, a more detailed FPQ was applied, including 49 food items (including alcoholic beverages), consumed in the last 12 months. An option for seasonal consumption was provided. For pregnant women, the same FPQ was used, but the reference period was the last three months.

For all age groups, a card with eight response options (eight categories of frequency) was provided to participants to help them to select the one most appropriate.

This questionnaire was included in the "You" module of the "You eAT&Move" e-platform.

3.2. Dietary recall and food records

Data was collected by trained fieldworkers by using Computer-assisted personal interviewing (CAPI). The field work was run over 12 months to minimise seasonal variability (from October 2015 to September 2016). Interviews were distributed over the four seasons and including all days of the week in order to incorporate seasonal effects and day-to-day variation in food intake. The week days of reporting were randomly selected. This procedure was accomplished whenever participants were available in the day after of the reporting day. For representing Saturdays, a 24-hour recall of the day before yesterday was performed on Mondays. In addition, an attempt was made to schedule the second interview for a day other than the day of the week of the first interview, with the exception of cases where the participant was only available to participate on the same day of the week.

Table 9 shows the distribution of the first and second interviews by weekdays and seasons of the year. Autumn was the season with a lower proportion of interviews, since the beginning and the end of the field work occurred at this time and naturally concentrated fewer interviews related with the usual logistic of population-based studies, for example with a slowest beginning.

Saturday was the day of the week with a lower proportion of interviews. This is explained by the fact that no interviews were scheduled on Sundays, thus the reporting of Saturdays was held on Mondays, which accumulated interviews from Saturdays and Sundays. Friday was the second day with a lower proportion of interviews, since not all Health Care Units were opened on Saturdays, despite the continuous efforts of the fieldwork team to have an alternative space for the interviews on Saturdays. In some of the cases, the alternative spaces were other Health Units of the same Association of Health Centres (ACES) that were open or even Town Councils or local Recreational Associations.

Table 9: Distribution of the first and second interviews by weekdays and seasons of the year

	Total		Female		Male	
Weekdays						
1st interview	n=5811		n=3018		n=2793	
Monday	1078	18.6%	598	19.8%	480	17.2%
Tuesday	1175	20.2%	613	20.3%	562	20.1%
Wednesday	1037	17.8%	539	17.9%	498	17.8%
Thursday	860	14.8%	431	14.3%	429	15.4%
Friday	530	9.1%	254	8.4%	276	9.9%
Saturday	338	5.8%	183	6.1%	155	5.5%
Sunday	793	13.6%	400	13.3%	393	14.1%
2nd interview						
Monday	1048	18.0%	556	18.4%	492	17.6%
Tuesday	1212	20.9%	662	21.9%	550	19.7%
Wednesday	1113	19.2%	577	19.1%	536	19.2%
Thursday	1101	18.9%	535	17.7%	566	20.3%
Friday	419	7.2%	205	6.8%	214	7.7%
Saturday	250	4.3%	149	4.9%	101	3.6%
Sunday	668	11.5%	334	11.1%	334	12.0%
Season						
1st interview						
Spring	2076	35.7%	1069	35.4%	1007	36.1%
Summer	1358	23.4%	670	22.2%	688	24.6%
Autumn	688	11.8%	355	11.8%	333	11.9%
Winter	1689	29.1%	924	30.6%	765	27.4%
2nd interview						
Spring	2095	36.1%	1090	36.1%	1005	36.0%
Summer	1514	26.1%	744	24.7%	770	27.6%
Autumn	600	10.3%	313	10.4%	287	10.3%
Winter	1602	27.6%	871	28.9%	731	26.2%
Combination between week and weekend days						
2 weekdays	3978	68.5%	2072	68.7%	1906	68.2%
2 weekend days	216	3.7%	120	4.0%	96	3.4%
1 weekday, 1 weekend day	1617	27.8%	826	27.4%	791	28.3%

Dietary intake was obtained by two non-consecutive days of 24-hour food diaries for children (<10 years old) and two non-consecutive 24-hours recalls for the other age groups (with an interval between eight and 15 days) using the eAT24 module, complemented with a FPQ, as described above. For children (<10 years old), the two non-consecutive one-day food diaries were followed by a face-to-face interview allowing the parent or other main caregiver to add details related with food description and quantification. For adolescents from 10-14 years, the 24-hour recall was administered with the presence of one of the parents or caregivers; for adolescents from 15 to 17 years, the 24-hour recall was administered without the need of parent's help.

The eAT24 module (Electronic Assessment Tool for 24-hours recall) allowed the collection of dietary data by an automated multiple-pass method employing five steps (Moshfegh et al, 2008). The software allowed subsequent conversion of foods into nutrients, using by default the Portuguese food composition table, continuously adapted.

This interview-based dietary assessment instrument allowed obtaining a very detailed description and quantification of foods, recipes, and food supplements consumed in the course of the preceding day. For quality control, the software provided, at the end of the interview, the individual energy and macronutrient intake for the corresponding evaluated day. The 24-hour recall is often structured with specific probes to help the respondent to remember all foods consumed throughout the day. In the middle and at the end of the interview there was a checklist with foods or snacks that might be easily forgotten, according to the following scheme:

- Quick List

- Place and time for each eating occasion
- Quick collection of foods and beverages consumed
- Special diet; special day
- Probe questions for foods forgotten during the Quick List
- Foods, recipes and food supplements description and quantification
 - Description using Facets and descriptors (FoodEx2 facets, other facets); quantification by photos, household measures, standard units, volume, weight, default
- Final probe question for forgotten foods
- Final quality control
 - Overall review; validity verification

The software, including the picture book, was tested in the pilot study.

3.2.1. Food description

The activities performed for the updating or development of food-related lists and the classification and description of foods are described in detail below.

Update of the food lists and recipe lists

Our initial food list was based on the 962 food items from the Portuguese food composition table (National Institute of Health Doutor Ricardo Jorge, 2006) with addition of items from the country-specific list defined at the Pilot-PANEU project (Ambrus et al, 2013). Several other food items, such as infant formulae, baby foods and ready to eat without processing items (such as desserts and drinks) were added during the field work, resulting in a list of 2479 items and 117 food supplement items. Food items were also classified according to the FoodEx2 system, described in detail below. Examples on these new food items added are: 25 new food items for the “ice cream” group (e.g. “ice cream bar, on a stick, chocolate cover”; “Ice cream, on a stick, not covered”; “ice cream cone”, “ice cream sundae”; “Ice cream sandwich”, etc.); 30 new items for the “Dry cakes, sweet biscuits” group (e.g. “Biscuit, filled n.s.”, “Biscuit, gluten free”, “Biscuit, “Belgian type”, “Biscuit, lactose free”, “Biscuit with chocolate pieces”, “Tarteletes”, etc.); 120 new items for the “Infant formulae” and 83 new items for the “Infant cereals” group, etc.

Regarding the recipe list, a new module was created including 1696 Portuguese typical recipes. The nutritional composition of recipes was calculated according to the methodology proposed by the EUROFIR network of excellence “Proposal for the harmonization of recipe calculation procedures” (Roe et al, 2013). During the data entry it was possible to automatically search and select any item from the food or recipe list. The lists included “not specified” items that could be chosen when the subjects did not know more specific information about the food eaten.

The software allowed the inclusion of new food and recipes during the data collection process. During the dietary survey the databases were updated regularly so that new foods, recipes and other information reported by the participants were added to the server common files.

Disaggregation of composite foods and recipes into main ingredients

This module initially included around 300 predefined recipes, based on Portuguese common recipes, plus 200 infant foods recipes - milks and baby cereals. Modifications of predefined recipes and inclusion of new recipes were performed continuously during field work by the compilers, resulting in a final list of 1696 recipes.

All the composite dishes/recipes can be disaggregated into their ingredients/food. If the ingredient composition of a specific composite dish/recipe was known by the participant, the recipe ingredients/foods were described by the participants using the applicable non-implicit facets according to EFSA FoodEx2 system (Table 10) (EFSA, 2011, EFSA, 2015). In these situations, the recipe composition was checked and changes to that composition could be appointed by the participant. New recipes could also be build and subsequently integrated in the recipe database by the compilers.

In any case, composite dishes were described according to 'recipe production', 'recipe brand name', 'recipe preservation method', 'recipe packaging format and material' and 'reheating method', and quantified.

Nutritional composition of recipes was calculated according to the methodology proposed by the EUROFIR network of excellence "Proposal for the harmonisation of recipe calculation procedures" (available at http://www.fao.org/uploads/media/reinivuvo_laitinen_2007_Eurofir_recipe_harmonisation_D2.2.12_M2.2.4_02.pdf).

Development of a list of food supplements

The list of food supplements was mainly based on the types of food supplements available in the national market. Supplements were described by the participant according to "packaging material" and "target-consumer". The amount consumed at the unit level was also collected (different methods of quantification were considered, described below).

Update of the brand names list

The brand name was asked for all food items that could have an associated brand name (the option of unknown was also available). Each subgroup of the food list had a list of predefined brand names. This list was based on the list of the Pilot-PANEU project (Ambrus et al, 2013) and complemented with data from the Portuguese market. During the data collection, new brand names were added to the brand name list.

Development of household measures list

The list of household measures was based on household measures commonly available in Portugal (e.g. suppliers for catering companies) and household measures used in other Portuguese picture books.

Connection of each food item with the Portuguese food composition table

As the food list included more items than the initial national food composition database (National Institute of Health Doutor Ricardo Jorge, 2006), the team supported the updating of the national food composition database. The process was coordinated by the INSA in straight collaboration with the University of Porto. The composition of food items not included in the Portuguese food composition table was picked from food composition tables of other countries. EuroFIR FoodEXplorer was used to extract the data.

Food classification and description

The foods included in the Portuguese food composition table were described using the implicit facets, if applicable, according to the EFSA FoodEx2 classification system. During the interview, the eAT24 methodology allows the description of consumed foods through other facets (non-implicit), if applicable, using the EFSA FoodEx2 classification system (EFSA, 2011, EFSA, 2015) (Table 10).

Each food item, recipe and food supplement has a predefined list of facets and descriptors. Facets and facet descriptors were customised to comply with the FoodEx2 facet descriptor system. The facets were systematically shown in separate windows and the user needed to select one or multiple descriptors before proceeding for the next window.

Table 10: Facets used to describe the food items

	FACETS IN THE eAT24 (non-implicit)	OTHER FACETS FoodEx2 (implicit)*
1	Source	
2		Part-nature
3	Physical-state	
4	Ingredient	
5		Flavour-note
6	Surrounding-medium	
7		Fat-content
8		Sweetening-agent
9	Fortification-agent	
10	Qualitative-info	
	10.1 Sugars-related info	
	10.2 Fat-related info	
11		Alcohol-content
12		Dough-Mass
13	Cooking-method	
14		Final-preparation
15	Preservation-technique	
16		Structural-treatment
17	Extent-of-cooking	
18		Packaging format
19	Packaging material	
20	Part consumed analysed	
21		Production-method
22	Preparation production place	
23	Target-consumer (only for supplements)	
24		Intended-use
25		Risky-Ingredient
26		Generic-term
27		Source-commodities
28		Process
29		Purpose of raising
30		Reproductive level
31		Animal age class
32		Gender
33		Legislative classes
xx	Brand name	

* Source: The food classification and description system FoodEx2 (draft-revision 1). (EFSA, 2011)

3.2.2. Determination of portion sizes

Selection of the quantification method for each food item and recipe

After description, consumed items were quantified using predefined methods. All foods, including beverages and food supplements, and composite dishes/recipes consumed during the 24-hours period, were quantified as eaten. Portion size actually consumed, taking into account left-overs was assessed. At the time of quantification, the specific methods that could be used for that specific item were presented in the QUANTIFICATION METHODS screen.

When volumetric quantification methods were used (VOLUME or HOUSEHOLD) the amount of food consumed (in grams) was calculated using the correspondent food density.

A maximum weight was defined for each food item. This variable was used as quality control during the data collection.

PHOTO method

A digital colour food picture book was developed including 186 food photo series with six portion each food/recipe item and 11 household measures photo series. The picture book includes foods or recipes specified for adults and children. In each photo series, food portion sizes were established taking into

consideration intake data obtained during the PANEU project (Ambrus et al, 2013) and available Portuguese and other European food picture books. An example of two photo series is presented below in Figure 3.

In the software, once this quantification method for a specific food/recipe was selected, a window opened with different portion photos. An example of quantification through the food photo series as it is showed in the eAT24 software is presented below in figure 4.

It was also possible to indicate whether the whole portion size or only a fraction of it was consumed and whether another serving from the same photo series was consumed or not.

As it is virtually impossible to include photos of all the foods in the food list, existing photo series were used to quantify different foods with similar densities.

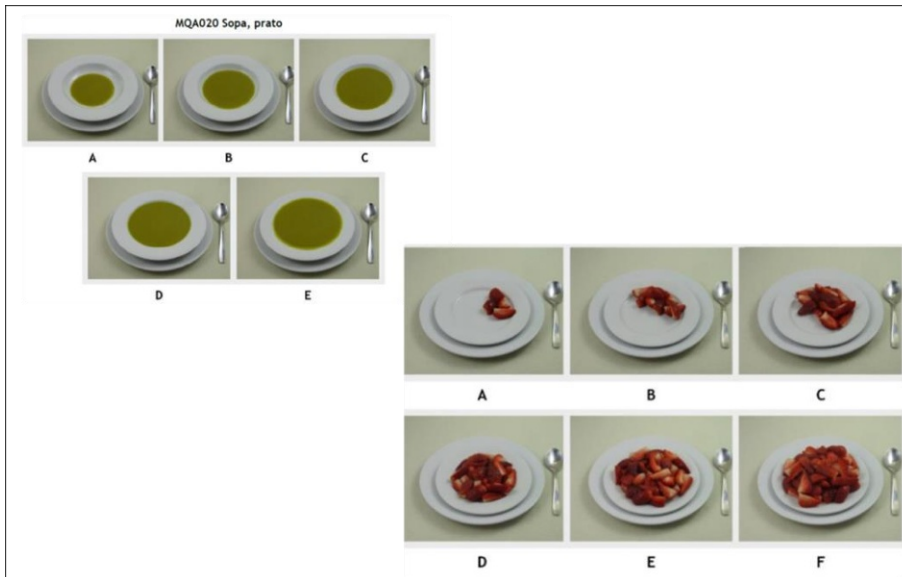


Figure 3: Food photo series of vegetable soup and strawberries.

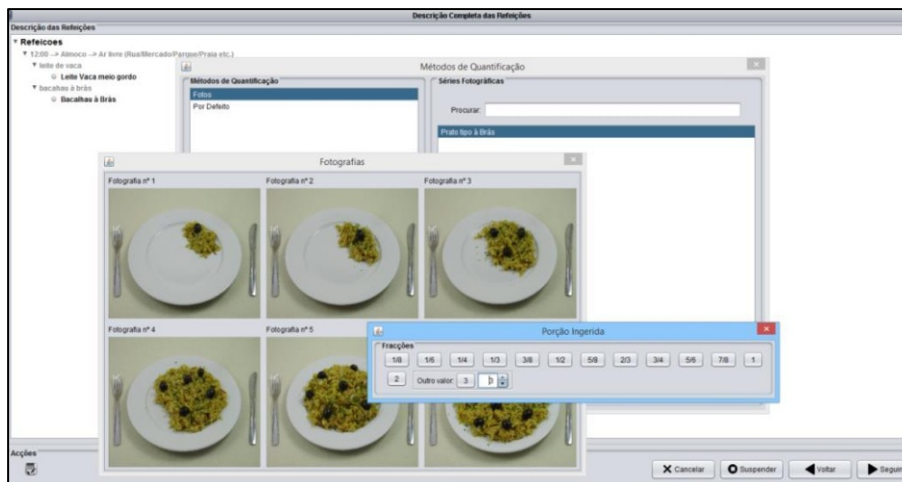


Figure 4: Quantification of cod fish recipe through the food photo series

HOUSEHOLD MEASURE method

A predefined household measure list was available to estimate the volume of portions. When the household measure method was selected, the interviewer should have selected one of the groups 'spoons', 'glasses', 'fast food glasses', 'cups and mugs', 'bowl' or 'plate'. Within each group a photo was associated with each household measure, with exception of 'spoons', 'fast food glasses' and

'plate' groups, and a fraction could have been selected. An example of photo series of household measures is presented below in Figure 5.



Figure 5: Food photo series of household measures.

WEIGHT or VOLUME method

In the software, this method was systematically available for all foods and recipes, and could have been used when the subject knew the quantity of the food consumed in grams or in millilitres. The quantity was manually entered by the interviewer.

STANDARD UNIT method

Standard units (STDU) were used for foods consumed in distinguishable units with more or less standard weights (e.g. piece of fruit, package of yogurt). For each STDU different fractions could have been used. The list of STDU was updated using Portuguese national market.

UNKNOWN method

This option was used when the subject was not able to estimate the quantity consumed using the methods described above. In this case, a mean portion was associated to the food item.

A list of mean portions was established for each portion when the participant selected the option "unknown". This mean portion was mainly defined as the mean portion of respective photo series from the picture book.

3.3. Other information

3.3.1. Questionnaires

The national Survey (IAN-AF) includes the evaluation of the following dimensions:

- Dietary and nutritional intake (24-hours recalls, food diaries, FPQ);
- Eating habits and behaviours;
- Supplements use;
- Food insecurity;
- PA (IPAQ, ACI, sedentary behaviours, PA diaries);
- Socio-demographics;
- General health data;

- Anthropometrics.

All the developed questionnaires were included in the electronic platform (“You eAT&Move” platform). In Table 11 the dimensions of data and used methodologies are systematised by each age group (plus pregnant women). The description of variables assessed in each dimension is presented in specific sections.

Table 11: Data dimensions by each age group (plus pregnant women).

Modules	Dimensions/Methodologies	Age groups (years)							Pregnant women
		3 mo-2	3-5	6-9	10-14	15-17	18-64	65-84	
You	Sociodemographics (SD) ^(a)	SD1	SD1	SD1	SD2	SD2	SD3	SD3	SD3
	General health (G) ^(b)	G1	G2	G2	G3	G3	G4	G4	G5
	Eating behaviours (EB) ^(c)	EB1	EB2	EB2	EB2	EB2	EB3	EB3	EB3
	Food propensity (FPQ) ^(d)	-	FPQ	FPQ	FPQ 2	FPQ2	FPQ2	FPQ2	FPQ3
	Food security (HFS) ^(e)	-	-	-	-	-	HFS	HFS	HFS
	Anthropometrics (A) ^(f)	A1	A2	A2	A2	A2	A2	A2	A3
eAT24	Food diary 1 (FD) ^(g)	FD1	FD2	FD2	-	-	-	-	-
	Food diary 2 (FD) ^(g)	FD1	FD2	FD2	-	-	-	-	-
	24h-recall 1 (24h)	-	-	-	24h	24h	24h	24h	24h
	24h-recall 2 (24h)	-	-	-	24h	24h	24h	24h	24h
Move	Physical Activity diary (PAD)	-	-	PAD	PAD	-	-	-	-
	International PA Questionnaire (IPAQ)	-	-	-	-	IPAQ	IPAQ	IPAQ	IPAQ
	Activity Choice Index (ACI)	-	-	-	-	ACI1	ACI2	ACI2	ACI2
	Other PA behaviours (PA) ^(h)	-	PA1	PA2	PA3	PA4	PA5	PA5	PA6

Dimensions assessed at the 1st interview

Dimensions assessed at the 2nd interview

- (a): Includes information on sex and age (from the registry lists) and questions about level of schooling, marital status, household income and structure, place of births, nationality and professional activity. SD1 and SD2 differ from SD3 because they include sociodemographic questions about parents (place of birth, nationality, education and professional activity), the current school year (SD2), and do not include questions about marital status and family income.
- (b): Includes the prevalence of diseases requiring regular medical care (pre-defined list) (SG1-SG5), diseases previously diagnosed by a physician (SG4 and SG5), general health condition (SG3, SG4 and SG5) and current and past smoking habits (SG3, SG4 and SG5). In women (SG4 and SG5), information on the gynaecological history and, in the case of pregnant women, on the current pregnancy (SG5) was included.
- (c): Includes questions on breastfeeding and formula feeding (C1), food weaning (C1) and a questionnaire on the frequency of consumption of fruit and vegetables (C1, C2, C3). C3 also includes questions on the use of food organic products, washing and disinfection of foods and an analogical scale of salt consumption.
- (d): Evaluated through a Food Propensity Questionnaire (FPQ). FPQ1 includes questions about the consumption of 45 food items in the last month; FPQ2 includes 49 food items (including alcoholic beverages) consumed in the last 12 months and includes an option for seasonal consumption; FPQ3 is similar to QPA2, but the reference period was the last 3 months.
- (e): Assessed by the Household Food Security (HFS) survey module, from the age of 18.
- (f): Includes weight and length recorded from the child health chart and objectively measured (A1), self-reported and objectively measured weight and height, as well as measurement of arm, waist and hip circumferences (A2). In the case of pregnant women (A3), it includes estimates of pre-pregnancy weight, self-reported height, and height and weight measured.
- (g): FD1 and FD2 are similar, but FD1 includes a specific structure for recording information on breastfeeding and formula feeding.
- (h): Includes questions about sleeping habits and regular practice of structured leisure-time physical activity. PA1 differs from PA2 and PA3 in the type of sedentary behaviours evaluated.

Socio demographic and behavioural information

The “You” module of the “You eAT&Move” platform includes data on socio-demographics. Sex and age (calculated using the first interview date and birth date) were automatically imported from datasets obtained from the National Health Registries. These data were checked during the first contact with the participants. They were also asked on their place of birth, nationality, marital status, number of completed years of education, professional situation, household structure and household

income. Closed questions were used for all domains. In the case of household income, a card with 11 answer options was provided to participants to select the one which best suits to their household.

Questions on health-related data were also asked, such as the presence of any disease that currently requires regular medical care, diseases previously diagnosed by a physician, self-report of health status, and current and past smoking habits. In women, the gynaecological history was also asked, and in pregnant women data on current pregnancy (gestational weeks, health problems) were additionally obtained.

Some aspects of eating habits and behaviours were included in the general questionnaires (use of food organic products, food safety behaviours, such as ways of washing fruit and vegetables) and some additional questions on salt consumption. Salt intake was also estimated in a sub-sample of participants using 24-hours urinary samples. In children, questions related to breastfeeding, consumption of different milk options and weaning were also included.

Food insecurity assessment was obtained by applying a slightly modified questionnaire developed by Radimer/Cornell (Radimer et al, 1990), widely applied in the evaluation and monitoring of public food assistance programs in the USA and in other countries (Bickel et al, 2000), and adapted for Portugal by INSA and ERS/USDA. It provided estimates of food insecurity for households with and without children under the age of 18, by collecting information on four underlying dimensions and experience of food insecurity: availability, access, utilization, and stability / resilience. In this way, food insecurity is associated not only with structural poverty, but also with transitional - but not less serious - conditions of scarce, in particular financial resources. The food insecurity status of each household lies somewhere along a continuum, extending into three categories as: food security (households had no problems, or anxiety about, consistently accessing adequate food), moderate food insecurity (households reduced the quality, variety, and desirability of their diets, but the quantity of food intake and normal eating patterns were not substantially disrupted) and severe food insecurity (at times during the year, eating patterns of one or more household members were disrupted and food intake reduced because the household lacked money and other resources for food).

Physical activity (PA)

PA levels were assessed by PA diaries (two consecutive days during the week and two of the weekend) for children (6-9 years) and adolescents (10-14 years) and by the IPAQ – International PA Questionnaire short version (Craig et al, 2003) for the other age groups (≥ 15 years old).

The PA diaries were an adaptation of a model (Bouchard et al, 1983), in which children registered their activities in a logbook for each 15 minutes interval during four days, according to previous written instructions.

Additional questions on sedentary behaviours were also asked in all age groups (including in children from 3-6 years of age) by using the ACI – Activity Choice Index (Mullen et al, 2016). Self-reported activities representative of “opportunistic” active choices during daily living (e.g., taking the stairs, parking further away from an entrance, choosing to stand instead of sitting, etc.) were assessed for the last month with six items with response options on a 5-point Likert scale (i.e., 1= never, 5 = always). Composite scales can be calculated by an average of the items.

A question on structured leisure time PA activity, detailing the type and time of activity, was also asked in all age groups from six years of age.

This information was inserted in the “Move” module of the “You eAT&Move” e-platform, which allows the collection of PA data, synchronised with metabolic equivalents data associated with each type of PA).

For all types of activity, daily energy expenditure was computed using the energy cost of each activity as estimated from reference values for participants higher than 15 years of age (Ainsworth et al, 2000, Ainsworth et al, 2011) and using an adaption for children based on values proposed by Ridley K, et al (Ridley et al, 2008).

In children, energy expenditure was estimated by multiplying the related MET by the self-reported time spent in each activity (min/day) recorded in the diary. Individual daily energy expenditure was computed as the mean expenditure of the 4-day diaries.

To validate the information from PA diaries, PA was objectively measured by accelerometry in a sub-sample of 35 participants from six to 14 years of age. Participants were asked to wear accelerometers (ActiGraph GT3X models; Pensacola, FL) during four days, including two consecutive weekdays and two consecutive weekend days, the same registered in the PA diary. The total energy expenditure (kcal/day) measured by PA diaries was estimated by multiplying metabolic equivalents by time spent in each activity and compared with data from accelerometer. A minimum of 75% of complete information was necessary for considering a valid assessment, with at least one weekend day.

3.3.2. Measurement of body weight and height

Anthropometric measurements were performed in both children and adults according to standard procedures, by trained observers.

Body height was measured to the nearest tenth of a kilogram using a digital scale (SECA®, Columbia, USA) and height was measured to the nearest centimetre using a portable stadiometer (SECA®, Hamburg, Germany). For participants whose height was not possible to measure, the hand length was measured using a pocket ruler as an alternative (Guerra et al, 2014). For children with less than two years of age, recumbent length was measured to the nearest 0.1 cm with a measuring rod with large callipers (SECA® 207; Hamburg, Germany).

Arm, waist and hip circumferences were measured, using an anthropometric tape, in all age groups except in children lower than three years of age and in pregnant women. Arm circumference was measured at the marked level of the mid-acromiale-radiale. Waist circumference was measured at the level of the narrowest point between the lower costal border and the iliac crest. Hip circumference was measured at the level of greatest posterior protuberance of the buttocks. All these circumferences were performed to the nearest 0.1 cm.

The protocol of anthropometric measures developed in the pilot PANEU (Ambrus et al, 2013) and PANCAKE (Ocké et al, 2012) projects were followed.

3.3.3. Food supplements

The use of food and nutritional supplements were asked by two methods. The first one using the 24-hours recall, in which supplements and foods consumed during a 24-hour period, were recorded per consumption occasion and quantified and described as eaten. The eAT24 methodology required the description of supplements during the dietary interview according to six facets (Supplement Source, Target Group, Place of Acquisition, Packaging Material, Brand and Physical State) and the respective descriptors.

The time (meal) of consumption was also recorded for each eating occasion. This interview-based dietary assessment instrument allowed obtaining a very detailed description of supplements consumed in the course of the preceding day.

The use of supplements in the last 12 months was also asked in the “YOU” module of the e-platform, in which information on the frequency of consumption (seven frequency categories were provided) of a pre-defined list of 16 different supplement types was asked (e.g. supplements of vitamins, such as C, D and folate, supplements of minerals, such as calcium and iron, multivitamins, supplements of fatty acids, herbs and plants, probiotics, etc.). The main place of acquisition of supplements was also recorded by a close question (possible answers: pharmacy, dietetic store, supermarket, online shopping or sports centre).

4. Administration of the interview

4.1. Selecting the examination site

The examination site was selected according to participant’s preference: the participant’s home (<1%) or the Primary Health Care Unit. In both cases, a team of two fieldworkers was responsible for the interview. The Regional coordinators controlled the allocation of the interviews to each team of fieldworkers through the e-platform.

4.2. Content and organization of the study visits

4.2.1. First contact

Participants were invited to participate by a first phone contact. When oral acceptance was provided, an invitation letter with participation details was sent to the participants, including already the information of time and place of the two face-to-face interviews, as well as the informed consent form. In children, a detailed explanation by phone to the parents or caregivers on how to fill the food diaries and the indication of the week day of reporting (previously randomly selected) was provided. A second call was performed to parents, after the reception of post information, to be sure about the reception and understanding of information.

4.2.2. First interview

In adolescents and adults at the first face-to-face interview, all the survey dimensions referred above (except food insecurity) were collected, and a 24-hours recall was applied. The anthropometrics physical examination was also performed.

In children, all the survey dimensions (except food insecurity) were collected and the checking and handling of the food diary at the eAT24 software was performed.

It was planned that the average duration of the interview should not exceed 1.5 hours (30 minutes for the dietary interview and the remaining for the other dimensions). In the IAN-AF, the first interview had a median duration of 61 minutes.

4.2.3. Second interview

It was planned that the second interview for all participants was with an interval between eight and 15 days from the first one. In the IAN-AF, the mean difference between the 1st and 2nd interviews was 11.2 days (median of 10 days).

In adolescents, adults and elderly, at the second face-to-face interview, the second 24-hours recall was performed. In adults (≥ 18 years old), the food insecurity dimension was also assessed. Participants were not aware that specifically a second 24-hours recall would be performed.

In children, the second face-to-face interview included the checking and handling of the second food diary.

It was planned that the average duration of the second interview was 45 minutes (30 minutes for the dietary interview). In the IAN-AF, the second interview had a median duration of 36 minutes. Figure 6 summarizes the recruitment process of participants.

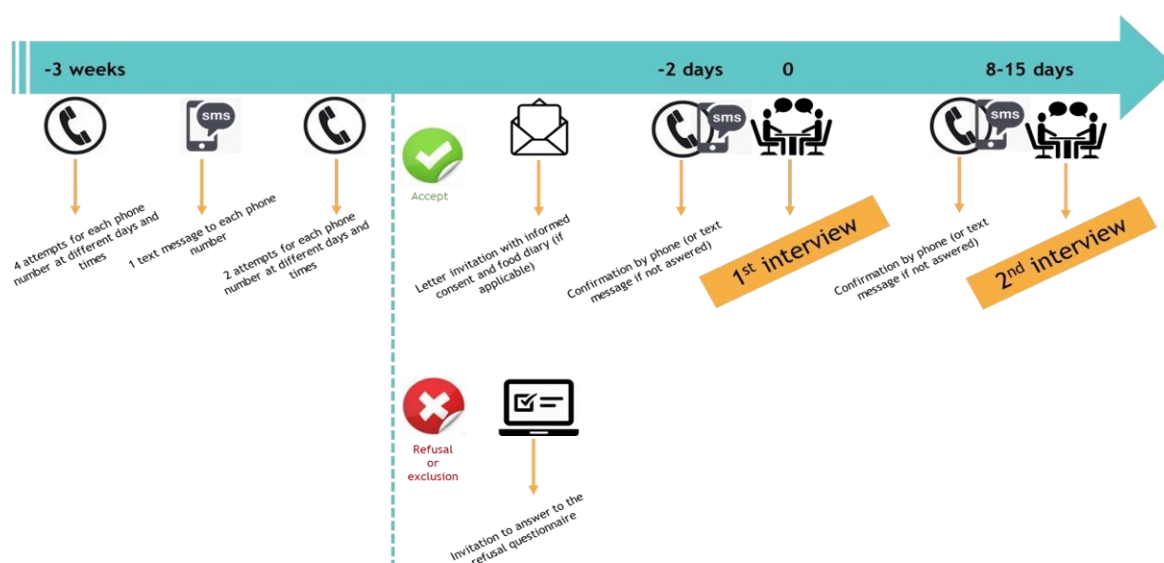


Figure 6: Diagram of participant's recruitment

4.2.4. Interviewing and checking of questionnaires

Data was inserted directly into a computer program, which facilitated the introduction and checking of the validity of the data in real time during the interview. Specific questionnaires according to age group were automatically selected from the electronic platform.

For all food items, a maximum quantity was predefined and if exceeded during the data collection an alert question was triggered. For quality control, the software provided, at the end of the interview, the individual energy and macronutrient intake for the corresponding evaluated day (if above or below the normal range, double checking of the quantities recorded was performed by the interviewer). Nutritional information of new foods and recipes was not considered in this estimate. Information on quantities of new foods or recipes collected as free text remarks was continuously checked by compilers.

As data have been collected, automatic checking for completeness of errors was performed. Both food diaries and 24h-recalls were recorded at the eAT24 module during interviews. However, for some items not previously included, namely for new recipes or food items an a-posteriori codification was performed by trained coders. Physical activity diaries were handled in the specific module of the software, after codification. The coders also checked non-dietary data.

The process of checking for completeness of errors in data handling, namely those related with the development of new recipes or food items at the platform (according to the harmonised procedures proposed by the EUROFIR network), was managed continuously during data collection.

4.3. Recruitment and training of the staff

4.3.1. Selection of the fieldwork staff

Data was collected by trained fieldworkers. Preference was given to fieldworkers with background in Nutrition and Dietetics.

4.3.2. Training

National and Regional field coordinators were trained by the team members (researchers from the Consortium from each institution with background in Nutrition, Physical Activity and Epidemiology) who subsequently trained and supervised the interviewers.

Interviewers had an initial training of two-days with the entire team. After, there were two other one-day sessions at the different regions with the local teams, some face-to-face and others using distance devices. Interviewers had also one week training within the pilot study. Additional training sessions were performed during the fieldwork as part of quality data supervision, particularly related with the use of eAt24 software.

Training included the introduction to protocols (including standard operating procedures) and training manuals, and training of techniques for conducting dietary interviews, using the 'You eAt&Move' platform, the FPQ and the food insecurity questionnaire. Techniques for conducting PA interviews, using the IPAQ questionnaire and the PA diaries were also taught, as techniques for anthropometric measurements. The supervision of interviewers by the Regional field coordinators was an on-going process during the fieldwork.

5. Quality assurance

A quality control for actions during the field work was implemented, namely:

- Each collaborator had his tasks, competences and responsibilities well defined
- The Coordination fieldwork team (two members at national level and five at regional level) ensured the supervision of the project in close contact with the fieldworkers and the management team of researchers
- Weekly meetings were performed by the field work coordination team

- Interviewers were trained and supervised by the Regional coordinators before and during data collection, and the procedures were kept up-to-date (distance electronic devices were used to assist interviews, when needed)
- Recruiters were also supervised during the recruitment process, in order to assure that participants were contacted according to standardised procedures
- Communication between the different partners and organizations was promoted
- The potential participants were selected by a sampling protocol
- Data collection was monitored, and when necessary, adapted
- The non-response rate was calculated and a refusal questionnaire was applied in order to check the representativeness of the final sample
- Representativeness by age, sex, region and socioeconomic status were checked
- The distribution of days of registry was checked (an equal distribution of days between 10-18% was planned)
- The distribution of seasonality was checked (an equal distribution of days between 20-30% was planned)
- A periodic calibration of scales using standard weights of 5000g and 500g and their combinations was performed.

During data handling, the following procedures were implemented:

- The eAT24 module provided, at the end of the interview, the individual energy and macronutrient intake for the corresponding evaluated day
- In the eAT24 module, a maximum weight was defined for each food item. This variable was used as quality control during the data collection
- Doubts were listed in an editor book and resolved by the research team continuously
- Some preliminary statistical analyses were performed after the pilot study and during the field work, in order to detect possible observation bias, as a process of supervision of field work, allowing the correction of standardised of procedures
- Identification of under and over-reporters of energy intake, according to the protocol developed by the pilot PANEU project was performed. Specific statistical analysis for identification of under- and over-reporters, identification of outliers and removal of intra-individual variability preceded the final analysis.

In the anthropometric measurements, procedures were standardized, equipment was calibrated regularly, and missing data and duplicates were checked.

6. Data management

For performing the fieldwork (data collection), the project had an experienced team on conducting population-based studies, namely national surveys. The coordination of the project was performed by the University of Porto (FMUP). The management of the data collection was coordinated by two partners (Institute of Public Health, University of Porto for the four NUTSII regions at North and Islands, and Institute of Preventive Medicine and Public Health, Faculty of Medicine, University of Lisbon for the three NUTSII regions at South). The process of checking for completeness of errors in data handling, namely those related with the development of new recipes or food items at the platform (according to the harmonised procedures proposed by the EUROFIR network) and FoodEx2 codification, was managed by Faculty of Nutrition and Food Sciences, University of Porto (FCNAUP), and National Health Institute Doutor Ricardo Jorge (INSA) partners. The coding process related with PA diaries and questionnaires was managed by Faculty of Sports, CIAFEL, University of Porto (FADEUP) and Faculty of Human Kinetics, CIPER, University of Lisbon (FMHUL) partners. The development of the e-platform and the adaptation of the eAT24 software were performed by the U.Porto partners in collaboration with SilicoLife, Lda. The enterprise was responsible for the management of the e-platform and for the systematic back up of databases.

All coordinators and interviewers had access to the electronic platform by using a private password. The final data were exported from the platform and were managed by the team of statistics from the FMUP.

Data collected will be integrated in the EFSA Comprehensive European Food Consumption Database following the data transmission schema provided by EFSA.

7. Dissemination and publicity

A detailed plan of the dissemination activities was discussed/agreed upon with all partners and activities were jointly decided. Dissemination of the research methods/tools, and findings used electronic and non-electronic media, targeting audiences such as relevant official bodies existing in the involved academic and health institutions, policy makers and stakeholders.

Some of the dissemination activities performed were:

- Setting up a website at the promoter Centre (www.ian-af.up.pt), available in Portuguese and English, where useful information about the project and its related activities can be found.
- Methods and tools, namely questionnaires, are available at the website, and can be downloaded from the website by any person.
- A final report with the IAN-AF results and a report on methodologies followed in the Survey were produced and are available at the website. A summary leaflet with the main results is also available.
- Social networks were created, as well as posters and newsletters informing participants and the general health community about the project.
- The project was disseminated through local media identified in each geographical region, following the timeline and location of field work and according to a communication plan coordinated by the office of the University of Porto rectorate.
- IAN-AF findings and policy/practice suggestions were presented at scientific and lay meetings, allowing dissemination to policy makers, health professionals, researchers, and civil society organisations.
- A workshop with the partners, policy makers, the national health regions, civil society organisations, professional and academic organisations, and other key and field professionals was organised to discuss the sustainability of a future surveillance system.
- A final public meeting was organised, both in Porto and Lisbon, to communicate and to discuss the main results of the project, extensively disseminated by national media.
- Publications in international journals with peer review are planned.

8. Special issues/challenges

The project was approved by EFSA to start in October, 2012. However, due to financial constraints, the funding from the Portuguese Government was delayed. After one year, the team has requested to EFSA the postponement of the project, explaining the budget constraints we were facing. In November, 2014 the Secretary of State Assistant to the Minister for Health has reinforced the importance and priority of a National Dietary Survey and his commitment in this process, but only in 3 of March 2015 we have received the official confirmation of the IAN-AF funding.

Other aspects that delayed the initial phase of the project were the access to the information of the sampling frame in order to start the recruitment of participants, related with administrative constraints and ethical approval issues.

Other main challenges in the project were: a) a lower response rate than initially expected and only a part of the refusals accept to answer to a questionnaire in order to be possible the comparison with participants. However, considering the burden of a dietary survey, including two moments of interview, this participation rate could be considered as acceptable and similar to other European surveys that used similar sampling approaches; b) the constraints related with the recruitment of

interviewers and the waiver of interviewers, particularly in islands where the recruitment of field works was more problematic; c) the complexity in developing the software for data collection and the management of big datasets (large number of variables and cases in longitudinal formats). The updating of the software for data collection during field work and the management of the editor book, particularly related with new food items and recipes, and considering the FoodEx2 classification was time-consuming. Nevertheless, it was strength of the project the fact of the initial structure of the software includes revision of the food items and pre-coded information (including FoodEx2 facet descriptor system) and considering the conversion of food into nutrients at the food item level.

Conclusions

The National Food, Nutrition and Physical Activity Survey of the Portuguese general population including children, adolescents, adults and elderly filled a 35-year-long gap after the previous official national dietary data collection in 1980.

Findings from this survey allowed having national updated knowledge on the distribution of diet, PA and other health-related risks of participants based on their sex, age, geographical region and education. The project expects to contribute to the development of national and European evidence-based policies which translate research into effective nutrition and health strategies, sustainable across time.

Although several financial constraints hampered the initial time schedule to be accomplished, the Consortium had done all the efforts to assure the progress of activities and to maintain the end of the project until December 31, 2016.

The development of an advanced platform “You eAT&Move”, the protocols and procedure manuals (including also questionnaires), standardised according to EFSA guidelines, will allow a future systematic assessment and monitoring of dietary intake and other health indicators, at regional, national and European levels.

This project contributed to develop and consolidate solid infrastructures for epidemiological and public health research by building a national functioning registration system on diet, PA and other health behaviours, reproducible across time. This will help to define targets at national and regional level, namely in low socio-economic groups needing specific nutritional interventions, helping to decrease social inequalities.

The project also promoted the improvement of human resources on technical and scientific competences, supporting the development of a public health workforce.

References

- Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, et al, 2000. Compendium of physical activities: an update of activity codes and MET intensities. *Medicine and science in sports and exercise*. 2000 Sep;32(9 Suppl):S498-504. PubMed PMID: 10993420. Epub 2000/09/19. eng.
- Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett DR, Jr., Tudor-Locke C, et al. 2011 Compendium of Physical Activities: a second update of codes and MET values. *Medicine and science in sports and exercise*. 2011 Aug;43(8):1575-81. PubMed PMID: 21681120. Epub 2011/06/18. eng.
- Ambrus Á, Horváth Zs, Farkas Zs, Cseh J, Petrova S, Dimitrov P, Duleva V, Rangelova L, ChikovaIscener E, Ovaskainen M-L, Pakkala H, Heinemeyer G, Lindtner O, Schweter A, Naska A, Sekula W, Guiomar S, Lopes C and Torres D, 2013. Pilot study in the view of a Pan-European dietary survey—adolescents, adults and elderly. Available online: <http://www.efsa.europa.eu/en/supporting/pub/508e>.
- Bickel G, Nord M, Price C, Hamilton W, Cook J. *Measuring Food Security in the United States, 2000: Guide to Measuring Household Food Security - Revised 2000*. Virginia: USDA: 2000.
- Bouchard C, Tremblay A, Leblanc C, Lortie G, Savard R, Theriault G, 1983. A method to assess energy expenditure in children and adults. *The American journal of clinical nutrition*. 1983 Mar;37(3):461-7. PubMed PMID: 6829488. Epub 1983/03/01. eng.
- Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al, 2003. International physical activity questionnaire: 12-country reliability and validity. *Medicine and science in sports and exercise*. 2003 Aug;35(8):1381-95. PubMed PMID: 12900694. Epub 2003/08/06. eng.
- Creavin ST, Wisniewski S, Noel-Storr AH, Trevelyan CM, Hampton T, Rayment D, et al, 2016. Mini-Mental State Examination (MMSE) for the detection of dementia in clinically unevaluated people aged 65 and over in community and primary care populations. *The Cochrane database of systematic reviews*. 2016 Jan 13(1):CD011145. PubMed PMID: 26760674. Epub 2016/01/14. eng.
- European Food Safety Authority (EFSA), 2009. General principles for the collection of national food consumption data in the view of a pan-European dietary survey. *EFSA Journal* 2009; 7(12):1435. [51 pp.]. doi:10.2903/j.efsa.2009.1435. Available online: <http://www.efsa.europa.eu/en/efsajournal/pub/1435.htm>
- EFSA. The food classification and description system FoodEx 2 (draft revision 1). EFSA Supporting Publications 2011;215:438 pp.
- EFSA, 2014. Guidance on the EU Menu methodology. *EFSA Journal* 2014; 12(12):3944. [77 pp.]. doi:10.2903/j.efsa.2014.3944. Available online: <http://www.efsa.europa.eu/en/efsajournal/pub/3944>
- EFSA, 2015. The food classification and description system FoodEx 2 (revision 2). EFSA Supporting Publications. 2015;12(5):EN - 804. 90 pp.
- Folstein M, Folstein S, McHush R, 1975. 'Mini-mental state'. A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12:189-98.
- Guerra RS, Fonseca I, Pichel F, Restivo MT, Amaral TF. Hand length as an alternative measurement of height. *European journal of clinical nutrition*. 2014 Feb;68(2):229-33. PubMed PMID: 24169457. Epub 2013/10/31. eng.
- Guerreiro M, Silva AP, Botelho MA, Leitão O, Castro-Caldas A, Garcia C, 1994. Adaptação à população portuguesa da tradução do "Mini Mental State Examination" (MMSE) [Adaptation of the Mini Mental State Examination's translation to the Portuguese population]. *Revista Portuguesa de Neurologia*. 1994;1:9-10.
- International Agency for Research on Cancer (IARC), 2013. Food Consumption Data Collection Methodology for the EU Menu Survey (EMP-PANEU) Final Report (Phase 3). EFSA supporting publication 2013:EN-485, 85 pp. Available online: http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/485e.pdf
- Kish, Leslie. *Survey Sampling*. 1965. New York: John Wiley & Sons, Inc. ISBN 0-471-10949-5.

Moshfegh AJ, Rhodes DG, Baer DJ, Murayi T, Clemens JC, Rumpler WV, et al, 2008. The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. *The American journal of clinical nutrition*. 2008 Aug;88(2):324-32. PubMed PMID: 18689367. Epub 2008/08/12. eng.

Mullen SP, Silva MN, Sardinha LB, Teixeira PJ. Initial Validation of the Activity Choice Index Among Overweight Women. *Research quarterly for exercise and sport*. 2016 Jun;87(2):174-81. PubMed PMID: 27030291. Epub 2016/04/01. eng.

National Institute of Health Doutor Ricardo Jorge, 2006. Food Composition Table [in Portuguese: Tabela da Composição de Alimentos]. 2006. Lisbon: Center of Food Safety and Nutrition, editor.

Ocké M, de Boer E, Brants H, van der Laan J, Niekerk M, van Rossum C, Temme L, Freisling H, Nicolas G, Casagrande C, Slimani N, Trolle E, Ege M, Christensen T, Vandevijvere S, Bellemans M, De Maeyer M, Defourny S, Rupich J, Dofkova M, Rehurkova I, Jakubikova M, Blahova J, Piskackova Z, Maly M, 2012; PANCAKE – Pilot study for the Assessment of Nutrient intake and food Consumption Among Kids in Europe. *Supporting Publications 2012:EN-339* [120 pp.]. Available online: www.efsa.europa.eu/publications

Radimer K, Olson C, Campbell C. Development of indicators to assess hunger. *Journal of Nutrition*. 1990;120:1544-8.

Ridley K, Ainsworth BE, Olds TS. Development of a compendium of energy expenditures for youth. *The international journal of behavioral nutrition and physical activity*. 2008 Sep 10;5:45. PubMed PMID: 18782458. Pubmed Central PMCID: PMC2564974. Epub 2008/09/11. eng.

Roe MA, Bell S, Oseredczuk M, Christensen T, Westenbrink S, Pakkala H, et al, 2013. EUROFIR. External scientific report. Updated food composition database for nutrient intake.2013. EFSA supporting publication 2013-EN-355. Available online: <http://www.efsa.europa.eu/en/supporting/doc/355e.pdf> [Accessed 10 September, 2015].

Statistics Portugal (INE - Instituto Nacional de Estatística). Population by residence, sex, age group and naturality - Census 2011. 2012. Available from: <http://censos.ine.pt>.

Abbreviations

ACI	Activity Choice Index
ACSS	Central Administration of the Health System, Portugal
DAFNE	The Data Food Networking (DAFNE) initiative - European Food Availability Databank based on Household Budget Surveys
DGS	General Directorate of Health, Portugal
eAT24	Electronic Assessment Tool for 24-hours recall
EEA Grants	European Economic Area (EEA) Grants Program, Public Health Initiatives
EFCOSUM	European Food Consumption Survey Method
EFSA	European Food Safety Agency
EGFCD	Expert Group on Food Consumption Data
ENHR	European Network for Housing Research
ERS/USDA	Economic Research Service/United States Department of Agriculture
FADEUP	Faculty of Sports, University of Porto
FCNAUP	Faculty of Nutrition and Food Sciences, University of Porto
FMHUL	Faculty of Human Kinetics, University of Lisbon
FMUL	AIDFM, Faculty of Medicine, University of Lisbon
FMUP	Faculty of Medicine, University of Porto
FPQ	Food Propensity Questionnaire
HabEat	HabEat Project - Determining factors and critical periods in food Habit formation and breaking in Early childhood: a multidisciplinary approach
HECTOR	HECTOR project (Eating Out: Habits, Determinants and Recommendations for Consumers and the European Catering Sector) EU-FP6
IAN-AF	National Food, Nutrition and Physical Activity Survey
IARC	International Agency for Research on Cancer
INSA	National Institute of Health Doutor Ricardo Jorge
IPAQ	International Physical Activity Questionnaire
EPI-Unit ISPUP	Unit of Epidemiology Research, Institute of Public Health, University of Porto
MET	Metabolic equivalent of task
MRC	Medical Research Council
NDNS	National Diet and Nutritional Survey
PA	Physical activity
PANEU	Pilot study in the view of a Pan-European dietary survey
PANCAKE	Pilot study for the Assessment of Nutrient intake and food Consumption Among Kids in Europe
RIVM	National Institute for Public Health and the Environment, Netherlands
STDU	Standard Unit