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National dietary survey on the adult population of Cyprus

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Abstract

The project CY 2014-2017-Lot2 is a dietary survey conducted in Cyprus at National level. The project was funded through an EFSA procurement under the EU Menu Project. The aim of the project is dual: the collection of detailed, harmonised and high-quality food consumption data of the adolescent and adult population in Cyprus (10-74 years old including pregnant women) according to EFSA specific requirements and the description of the collected data according to EFSA FoodEx2 food classification system. In total 812 people (adolescents 10-17 years old, adults 18-64 years old, and elderly 65-74 years old), participated in the survey, as well as 204 pregnant women. The method of random stratified sampling was applied for the selection of the participants using the list of Cyprus postal codes. Food consumption information was collected for two non-consecutive days, using the method of the 24-hour dietary recall method. Additionally, short food frequency questionnaire was applied in order to collect information on the consumption of food groups such as vegetables, legumes, dairy, meat, fish, poultry, oils and nuts and the consumption frequencies of food supplements. Information on weight, height and physical activity levels of participants was also collected during the survey. For participants aged 10-75 years old the response rate was relatively low - 47% - but with high participation rate - 99%. For the pregnant women response and participation rates were 90% and 98% respectively. Food consumption data were recorded in the "Greek Diet" Software and coded according to EFSA FoodEx2 food classification system. Quality control was applied at each stage of the survey ensuring the credibility of the collected data.

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Key words: Cyprus, food consumption, nutrition, adults, pregnancy, adolescence, FoodEx2

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Summary

The National Dietary survey (CY 2014-2017-Lot2), funded through an EFSA procurement under the EU Menu Project, is a dietary survey conducted in Cyprus for the collection of the food consumption data and eating habits of the Cypriot population covering adolescents, adults, elderly and pregnant women. The survey was conducted according to EFSA's Guidelines for the EU Menu Project. The survey included 812 participants (adolescents 10-17 years old, adults 18-64 years old and elderly 65-74 years old) and 204 pregnant women. The response rate was 47% for participants aged 10-75 years old and 90% for pregnant women.

The method of random stratified sampling was applied for the selection of the participants using the list of Cyprus postal codes. The sampling procedure ensured that 25% of selected participants in each age-group would have been surveyed in each season to capture inter-season variability in consumption. The initial target sample size was 300 participants for each age group, including a number of 400 pregnant women. However, the target sample size had to be doubled, because of low participation rate in contrast to pregnant women where participation rate was high. For the first recall, well-trained personnel conducted face-to-face 24hr dietary interviews with participants at their home. The second recall from each participant was via telephone. Portion sizes were determined by using electronic scales or the GloboDiet picture book, along with household measurements and standard units. A short food frequency questionnaire and the International Physical Activity Questionnaire (IPAQ) were administered; measures of height and weight of the participants were also taken.

The "Greek Diet" Software is composed of two MS Access databases which been used for data manipulation of the collected data. The first database (EFSAdatabaseCY) handled data regarding a) Demographic data, b) Anthropometry, c) Smoking habits, d) Food supplements intake, e) Physical Activity questionnaire (Short IPAQ), and f) Food Frequency Questionnaire. The second database (GreekDietDatabase) handled the data of two days diet recalls from participants.

The food data were recorded in the GreekDietDatabase and coded according to EFSA FoodEx2 classification system. For harmonisation purposes composite dishes were disaggregated into their ingredients according to standard recipes or to the description given by the participant and classified both as consumed (after processing) and as raw. A database was developed for the conversion of the cooked to the raw ingredients using yield factors. For quality control purposes and before transmission to EFSA, a decoding FoodEx2 software tool was developed for checking the decoded description with the original one.

A pilot study was carried out in the summer of 2014 in order to determine any potential problems and assess the quality of instruments and software that were to be used in the survey. No potential problems were encountered during the pilot phase. However, some of the problems encountered during the survey were: the complexity of the methodology and the complexity of the FoodEx2 classification and coding, the low participation rate, the continuous training of the interviewers (dietitians/nutritionists) and the technical problems of the data servers were all the collected data was stored.

The information collected concerning the nutritional habits of the Cyprus population (adolescents, adults, elderly and pregnant women) together with the experience gained in both the consumption data methodology and the FoodEx2 classification made this survey successful. The data collected will be further used for both nutritional analysis as well as more refined exposure assessment to chemicals and nutrients through food.

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1. Introduction and objectives

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

A long term objective of EFSA is the acquisition of a harmonised pan-European Food Consumption database within the framework of the EU Menu process "What's on the Menu in Europe?" (EU Menu).

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" (EFSA, 2009). The main objective of this Guidance was to recommend general principles for the collection of dietary information that can be used to estimate dietary exposure to food borne hazards and nutrients considered by EFSA's Scientific Panels and Units.

In December 2009, EFSA started the Article 36 project (CFP/EFSA/DATEX/2009/02) "Pilot study for the Assessment of Nutrient intake and Food Consumption Among Kids in Europe" (PANCAKE), 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. The final report of this project was published on the EFSA website in September 2012 (Ocke et al, 2012).

In December 2011, EFSA started the Article 36 project (CFP/EFSA/DATEX/2010/02) "Pilot study in the view of a Pan-European dietary survey – Adolescents, adults and elderly" (PANEU), coordinated by the Hungarian Food Safety Office to develop and test similar tools and protocols for the different adult population groups. The final results are described in the final report of this project published on the EFSA website in November 2013 (Ambrus et al, 2013).

The Guidance of EFSA on "General principles for the collection of national food consumption data in the view of a pan-European dietary survey" is scheduled to be updated in 2014 based on the outcomes of the above-mentioned pilot studies¹.

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 develop and adapt the EPIC-SOFT dietary software according to the needs of EFSA and to ensure that this software can be used by EU Member States for their dietary surveys within the context of the EU Menu process. The final report of this project called EMP-PANEU was published on the EFSA website in June 2013 (IARC, 2013)

The first and second support to national dietary surveys was provided by means of the calls for tender CFT/DCM/2011/02 and CFT/DCM/2012/01. Support for seven surveys from six Member States (Estonia, France, Latvia, Portugal, Spain, The Netherlands) was granted in 2011 and 2012

The aim of this procurement procedure is to award direct contracts to organizations from EU Member States, which have a governmental mandate to carry out a dietary survey at national level in the period from 2013 to 2018. Resources will be made available to support the adaptation of the methodology used in these surveys according to the EFSA Guidance document on the general principles for the collection of national food consumption data in the view of a pan-European dietary survey⁴. The dietary data collected through the activity should be available for EFSA's scientific activities without restrictions on its use.

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

- objective 1: to adapt the methodology to be used in the national food consumption survey according to the EFSA Guidance document on the general principles for the collection of national food consumption data in the view of a pan-European dietary survey,
- objective 2: to prepare and transfer to EFSA the national food consumption data and related information collected during the survey according to the format required by EFSA.

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>

This contract was awarded by EFSA to: State General Laboratory, Kimonos Street 44, 1451 Nicosia, Cyprus

Contractor: State General Laboratory, Kimonos Street 44, 1451 Nicosia, Cyprus

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 covering adults and adolescents from 10 up to 74 years old

Contract number: CT/EFSA/DCM/2013/02-LOT 2-CT02

2. Description of the protocol of the survey

This National Dietary survey is the first official national survey for the nutritional habits of the Cypriot population aiming to collect food consumption data from the Cyprus citizens in a harmonised way in order to support exposure assessment to chemicals and other risks of the Cypriot population through food.

The survey was carried out in the context of the European Food Safety Authority's "EU Menu" Project that aims to collect harmonised food consumption data at EU level – harmonised both in the collection and the coding.

The project was awarded to the State General Laboratory (SGL) and the Research and Education Institute of Child Health (REF) through an EFSA contract within the EU Menu project. The contract was signed between EFSA and SGL in 2013 with duration 4.5 years.

The Research and Education Institute of Child Health conducted all field work, since its members have extensive experience in conducting dietary surveys. This included selection of participants, contacting participants, performing face-to-face home visits, taking anthropometric measurements, collecting dietary recall data, administering Food Frequency Questionnaire (FFQ) and International Physical Activity Questionnaire (IPAQ) and finally collecting demographic information. Appendix C contains all the questionnaires used in the survey. Each one of these issues will be described in more detail in the following sections. The Research and Education Institute of Child Health undertook all updating and upgrading procedures of the software that was used as data collection tools.

The SGL, with the experience gained from participating in the FoodEx2 pilot project and in sending data electronically to EFSA according to specific requirements, carried out the FoodEx2 coding and was responsible for the data quality and data transmission to EFSA.

The fieldwork and the data collection were carried out from the summer 2014 to summer 2017.

The survey followed the EFSA guidelines (EFSA, 2009 & EFSA, 2014) and specifications for the survey and the data transmission.

2.1. Study population and exclusion criteria

This study included people (adolescents, adults and elderly people as well as pregnant women) living in the Government Controlled Areas of Cyprus.

According to the requirements of the project the total study population was divided into four groups:

- Adolescents from 10-17 years old
- Adults from 18-64 years old
- Elderly from 65-74 years old
- Pregnant women

There were excluded from the sampling framework the following groups:

- Persons aged >74 years old

- Institutionalised persons (such as retirement homes, people residing in hospitals, prisons, and military barracks)
- Persons at home care unable to feed themselves or feeding entirely with ready-to-feed regimes (i.e. not feeding with food – solids or beverages)
- Persons unable to communicate efficiently in Greek or English. The majority of 'Other EU inhabitants' and 'Inhabitants of other nationalities' in Cyprus can efficiently communicate in Greek and/or English.

2.2. Sampling frame

The REF team has undertaken the design LOT 2 of the survey. Three age groups and additionally a group of pregnant women recruited as follows:

1. Adolescents 10 to 17 years old, 300 subjects
2. Adults 18 to 64 years old, 300 subjects
3. Elderly 65 to 74 years old, 300 subjects
4. Pregnant women, 200 subjects.

In order to select the most representative sample possible for each of the four groups mentioned above, it has been decided to choose different sampling frames for each of the four groups as shown in the Table 1 below.

Table 1: Sampling frames used for the different population groups

Age-Group	Sampling Frame	Number of participants
Adolescents 10 to 17 years old	-Elementary Schools (5 th & 6 th grade) -Secondary schools	274
Adults 18 to 64 years old	List of Postal Codes	275
Elderly 65 to 74 years old	List of Postal Codes	264
Pregnant women	-List of private sector's obstetricians -List of public hospitals providing primary and tertiary obstetric care	204

2.3. Sampling method and design

2.3.1. Sampling of population groups

A stratified sampling technique was utilised for each of the groups taking into account the following strata:

- District; The freely-accessible areas of Cyprus (i.e. excluding occupied areas from the Turkish troops since 1974) are divided into five districts: 1) Nicosia, 2) Limassol, 3) Larnaca, 4) Paphos, and 5) Famagusta.
- Area of living, i.e. urban or rural areas; According to the 2011 census, approximately 67% of Cyprus population live in urban areas and 33% in rural areas. The proportion in each district is different. The district of Famagusta consists entirely of rural population given that the city of Famagusta is occupied by the Turkish troops.
- Sex; According to the 2011 census, the proportion of sex is different in the six age-groups, districts and area of living.

In order to get a representative sample REF used the most recent estimations of the population size by the Statistical Service of the Ministry of Finance of the Republic of Cyprus, which referred to the end of year 2012.

For each of the four groups a table was built with the estimation of the population at the end of 2012, in the above mentioned three strata. In order to calculate the number of needed sample in each strata the following formula was used:

$$[300] / [\text{tot population}] * [\text{strata population}]$$

Where, 300 refers to the needed number of subjects per age-group, [tot population] refers to the total population of the age group and the [strata population] refers to the number of the population in the strata.

The calculation for the number of needed sample in each strata is presented in the following Table.

Table 2: Calculated sample size in the three strata in each of the three age-groups and gender

Age Group	District	Urban		Rural	
		Males	Females	Males	Females
10-17 y	Nicosia	41	15	39	14
	Limassol	33	10	32	10
	Larnaca	16	12	16	11
	Paphos	12	5	11	5
	Famagusta	0	0	10	9
18-64 y	Nicosia	41	16	45	16
	Limassol	31	9	33	10
	Larnaca	14	10	15	10
	Paphos	11	4	11	5
	Famagusta	0	0	8	8
65-74 y	Nicosia	38	15	44	15
	Limassol	31	10	35	11
	Larnaca	14	10	15	10
	Paphos	13	6	13	5
	Famagusta	0	0	7	8
Total		295	122	334	147

2.3.2. Sampling of Pregnant Women

A similar stratified sampling technique was utilised to select pregnant women taking into account the District. Sex was not appropriate in this case, whereas ‘area of living’ was also not available, because the sampling frame is the list of private sector’s obstetricians and the List of public hospitals providing primary and tertiary obstetric care, which all are available in urban areas. The sampling followed the distribution of women of childbearing age (i.e. 15 to 50 years old) in the five districts of Cyprus is found in Table 3.

Table 3: Distribution of pregnant women per district

District	Population of childbearing women	Calculated Number needed	Number of Participants ^(a)
Nicosia	93,475	82	79

Limassol	66,506	58	56
Larnaca	32,881	29	34
Paphos	23,227	20	19
Famagusta	12,880	11	16
Total	228,969	200	204

(a): accepted participation

In order to calculate the number of pregnant women needed for our purposes we used the formula:

$$[200] / [\text{tot population}] * [\text{district population}]$$

Where, 200 refers to the needed number of pregnant women, [tot population] refers to the total women of childbearing age (i.e. 228,969) and, the [district population] refers to the number of the population of women of childbearing age in each district. Thus, in order to calculate the number of needed pregnant women living in the district of Nicosia we calculated it as:

$$200/228969*93475 = 82 \text{ (see Table 3)}$$

The distribution and response rate for the pregnant women is detailed in Table 4.

Table 4: Pregnant women – sampling distribution and response rate by season

	Winter		Spring		Summer		Autumn		Total
	n	%	n	%	n	%	n	%	n
Approached participants^(a)	50	21.9	60	26.3	57	25.0	61	26.7	228
Participants^(b)	42	20.6	57	25.0	49	21.5	56	27.5	204
1st recall	41	18.4	57	25.0	49	21.5	56	27.5	203
2nd recall	40	17.5	55	21.1	49	21.5	56	24.6	200

(a): were invited/ contacted

(b): accepted participation

2.4. Sample size

The implementation of this project CY 2014-2017-Lot2 required at least 260 participants (130 males and 130 females) for each group. This has been accomplished with the following number of participants:

- 272 Adolescents from 10-17 years old (132 male and 140 female)
- 275 Adults from 18-64 years old (136 male and 139 female)
- 264 Elderly from 65-74 years old (131 male and 133 female)
- 204 Pregnant women

In the following tables (5 to 9) information on the distribution of the general population per district, season and age class, gender and the relative response rate are detailed.

Table 5: Sampling distribution per district per gender

	10-17 years old		18-64 years old		65-74 years old		Total number of subjects
	Men	Women	Men	Women	Men	Women	
Nicosia	52	44	47	48	40	45	276
Limassol	38	36	32	34	33	38	211
Larnaca	22	28	32	27	27	23	159
Pafos	13	14	17	20	21	15	100
Famagusta	10	16	8	10	11	11	66
Numbers of full responders^(a)	133	137	134	138	130	130	802
Number of participants^(b)	135	138	136	139	132	132	812

(a): provided two 24hr dietary recalls

(b): accepted participation

Table 6: Sampling distribution per gender, age group and recall

	10-17 years old		18-64 years old		65-74 years old		Total n
	Men	Women	Men	Women	Men	Women	
	n	n	n	n	n	n	
Participants^(a)	135	138	136	139	132	132	812
1st recall	134	137	136	139	132	132	810
2nd recall	133	137	134	138	130	130	802

(a): accepted participation

Table 7: Sampling distribution and response rate by age

	10-17 years old		18-64 years old		65-74 years old		Total n
	n	%	n	%	n	%	
Approached participants^(a)	450	26.0	770	44.5	509	29.4	1729
Participants^(b)	273	33.6	275	33.9	264	32.5	812
1st recall	271	33.5	275	34.0	264	32.6	810
2nd recall	270	33.7	272	33.9	260	32.4	802

(a): were invited/ contacted

(b): accepted participation

Table 8: Sampling distribution by season

	Winter		Spring		Summer		Autumn		Total n
	n	%	n	%	n	%	n	%	
Approached participants^(a)	425	24.6	504	29.1	304	17.6	496	28.7	1729
Participants^(b)	208	25.6	241	29.7	154	19.0	209	25.7	812
1st recall	208	25.7	241	29.8	152	18.0	209	25.8	810
2nd recall	207	25.8	238	29.7	151	18.8	206	25.7	802

(a): were invited/ contacted

(b): accepted participation

Table 9: Response and Participation Rate for Lot 2 and pregnant women

	Approached eligible ^(a)	Participants ^(b)	Full responders ^(c)	Response rate (%) ^(d)	Participation rate (%) ^(e)
Lot 2	1729	812	802	47	99
Pregnant women	228	204	200	90	98

(a): were invited/ contacted

- (b): accepted participation
 (c): provided two 24hr dietary recalls
 (d): (participants / approached eligible) x100
 (e): (full responders/ participants) 100

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

The anticipated response rate was over 80%. However, there was an unexpectedly lower actual response rate (47%), except in the case of the pregnant women (98%). The reasons for the low response could be the long time required by the interviewer in order to collect all the necessary information and the low interest by the participants. Several efforts had been undertaken to achieve adequate response as are described in the following paragraphs. In order to calculate response and participation rates, the EFSA Guidance document was used (EFSA, 2014).

Therefore the following calculations were carried out:

Response rate = (participants/ approached eligible) x 100

Participation rate = (full responders/participants) x 100

Table 10: Non Responders and Drop- outs for Lot 2 and Pregnant women

	Participants ^(a)	Partial response (completed at least one 24hr recall)	Full response (completed two 24hr dietary recalls)	Non responders ^(b)		Drop outs ^(c)	
				n	%	n	%
Lot 2	812	810	802	2	0,2	8	0,9
Pregnant women	228	203	200	1	0,5	4	1,9

- (a): accepted participation
 (b): (total participants - partial responders) / total participants
 (c): (partial responders – full responders) / participants

Table 11: Distribution of full responders per Season

	Winter (%)	Spring (%)	Summer (%)	Fall (%)
10-75 years old	26%	30	18	26
Pregnant women	20%	27	25	28

Table 12: Final results of all the participants in LOT 2 per group

Age group	Participants ^(a)	Full responders ^(b)	Drop-outs	Participants Needed	Coverage with Full responders
	n	n	n	n	%
Adolescents 10 to 17 years old	271	270	2	260	103,8
Adults 18 to 64 years old	275	272	2	260	104,6
Elderly 65 to 74 years old	264	260	1	260	100

Sub Total	810	802 ^(c)	2	780	102.8
Pregnant women	203	200	1	200	100
Total	1013	1002	8	980	102,4

(a): accepted participation

(b): Number of participants with two 24hr recalls

2.5.1. Increase project's awareness

A brochure was prepared both in Greek and English. This brochure provided simple, but comprehensive information regarding the project. It was enclosed within utility bills so that every household was informed about the project.

2.5.2. Individualised report

We delivered an individualised report to each participant providing evaluation of body measurements, physical activity levels, and dietary status (based on FFQs). This report also provided general advice as to the need to improve any aspects that will be indicated as out of normal range.

2.5.3. Efforts for offering blood tests

We offered basic blood tests to participants as a special motive to participate in the project. We envisage offering a full blood count, serum lipid levels and fasting sugar.

2.5.4. Modified sampling procedure

Dietitians and nutritionist were given orders to visit more than one house per street as selected by postal code. We have also changed our initial sampling procedure regarding the adolescents group in LOT2:

The sampling frames for adolescents are different for the suggested in our original tender because it was more possible to reach the representative sample through elementary schools and secondary education schools (gymnasiums and high schools) as for all children up to the age of 12 years (100%) is mandatory to attend elementary schools while more than 90% of adolescents finally graduate from secondary education.

2.6. Legal and ethical aspects

The protocol of the study has been submitted to the national bioethics committee in Cyprus for approval. All participants provided written consent for themselves or for their children in case of participants aged below 18 years old. Adolescents also provided consent for themselves additional to the parental consent.

3. Dietary survey tools

3.1. Food frequency questionnaire

A short FFQ (Annex E & F) including fifty seven food items/ groups was used along with short questions in regards to diet habits of the participants: breakfast habits, orthodox fasting pattern and food supplementation intake. According to the answers, the MedDietScore for adults was automatically computed to give feedback to participants on their adherence to the Mediterranean Diet.

3.2. Dietary recall

Individuals were interviewed by dietitians/nutritionists that were well trained in conducting face to face and telephone 24hr dietary recalls. Interviewers collected data for the previous day since the responder got up until he/she got up in the next morning (however, after-midnight snacking was

recorded at 23:59 to avoid mistakes). The interviewers were performing one face-to-face interview at the participant's home and one more via the telephone. Because of low response rate no more than two recalls were assessed. Days recalled were non-consecutive, independent, 14 days apart. Interviewers were trained not to probe questions while the participant was recalling the food items he/she ate on the day before but only when the participant was having trouble remembering the food items he/she consumed. Interviewer would then come back at each meal reported and ask for extensive details for each food item. Then the interviewer was asking the participant for missing meals, food groups, beverages (including drinking water), snacks between reported meals/snacks and food items usually eaten with certain foods. No prior notification was being given to subjects whether or when they would be interviewed about their food intake during the home visit. Participants were informed about the upcoming telephone interview, for ethical reasons, but they were neither aware of the exact date nor about the fact that they would be re-interviewed about foods eaten.

3.2.1. Food description

During the home visit the participant provided details for the food items that he/she consumed on the previous day by leftovers or the same food if available. Foods consumed were described as much as possible. The brand and the package characteristics were reported i.e. fresh milk was clarified if it is cow/goat milk skimmed (usually blue package in Cyprus)/ semi-skimmed (usually yellow package)/ full fat (usually red package)/ lactose free/ plant sterols enriched/ fibres enriched/ calcium enriched etc. Furthermore information regarding flavour (i.e. for yogurt) or fat/sugar content was reported. Where possible, the physical characteristic of the packaging was tried to be recorded, for example whether it is glass, paper, plastic, aluminium etc. For home-made cooked recipes (and if possible for purchased meals) the cooking procedure (as well as temperature of cooking/ boiling/ frying) was described. Participants were also asked to describe the recipe according to its ingredients. For sandwiches/ beverages/ salads etc. whether homemade or purchased, participants were asked to distinguish components, if possible. It was specified in case of homemade food items that are typically purchased (i.e. bread, yogurt, jam etc.). In case of foods of high scientific interest extensive detailed information was collected (dietetic products, allergy food, fortified food, special diet products).

For the description and coding of the collected food, the FoodEx2 classification system of EFSA was used (EFSA, 2015). The browser and any instructions were regularly checked following EFSA's updating system. The coding was embedded in the GreekDietDataBase.

According to the Guidance on EU Menu methodology (EFSA, 2014), « all self-made composite dishes should be disaggregated and described on the component/ingredient level "as purchased"/ "as ingredient". The disaggregation should be based on information provided by the subject or if this is not possible by means of standard recipes». Therefore the composite dishes as defined by EFSA were disaggregated case by case: a) For sandwiches, salads and similar dishes that the participants defined the portion of each ingredient as well as the cooking method and b) the traditional "recipes" were disaggregated into their ingredients according to a standard recipe (either from the Cyprus Food Museum (CFM), the Hellenic Health Foundation (HHF) or as provided by experienced Cypriot chefs). In total the "Greek Diet" software contains 1435 foods of which the 156 are standard "RECIPES". After disaggregation the raw ingredients, were converted using a yield factor to the cooked ingredient and then both processed and raw ingredients were expressed per 100gr of edible portion to anticipate the amount consumed that was recorded in the Greek Diet Database. A database in the Microsoft office excel format was developed for the calculations for the conversion factors that was incorporated into the "Greek Diet" Software and is explained in Appendix A. Then all the ingredients both raw and cooked were coded by the FoodEx2 browser.

3.2.2. Determination of portion sizes

During the home visit the coloured GloboDiet picture book (of which license to use has been obtained by IARC) was used along with standard household measurements and standard units to determine portion sizes. Internet research during the home visit helped participants to recognize the brand and/or the package size of purchased food items. An electronic food scale was carried along, in order

to weigh leftovers or the same food, if available, that the participant consumed the day before. Description for packaged products was also helpful to capture the amount consumed. The portion that was left over was always indicated. During the telephone interview a good description of the portion was taken: according to centimetres in all three dimensions, package size, household measurements and standard units (mugs, cups, tablespoon, teaspoon, cans of 330ml, bottles of 500ml etc.).

3.2.3. Dietary software

The "Greek Diet" Software is composed of two MS access databases which have been used for data manipulation of collected data. The first database (EFSAdatabaseCY) handled data regarding a) Demographic data, b) Anthropometry, c) Food supplements intake, d) Physical Activity questionnaire (Short IPAQ), and e) Diet Questionnaire (Including FFQ). The second database (GreekDietDatabase) handled the data of 2 days diet recalls from participants.

The "Greek Diet" software was used as the recall diet data entry method. The "Greek Diet" software originally was updated with the latest Cypriot Food Composition Table, popular food items from the United States Department of Agriculture food composition table, and known food items frequently consumed available from commercial labels. Also the updated and upgraded software allows the interviewer to enter all the food item's characteristics: brands, flavour, fat/ sugar content, fortification information, cooking procedure, report in case of re-heating, physical characteristic of the packaging (glass, paper, plastic, aluminium), specification in case of homemade food items that are typically purchased.

The software was continuously upgraded during this survey in order a) to accommodate the disaggregated recipes with their ingredients, b) to accept the in-house FoodEx2 decoding tool, c) to add new food items/recipes that were reported by participants and d) to check the data entry a new application (max portion tool) had been incorporated on the Greek Diet Database, where if quantities appear to be unreasonable a question pops up: "Is this the right amount?".

The food description and coding in FoodEx2 was built in the GreekDietDatabase using all the available information via the FoodEx Browser and then inserted in a specific column embedded in the software. The disaggregated recipes were also included. In order to ensure high quality of the coding, each FoodEx2 code was double-checked against the "core code" of the corresponding food item, which was already incorporated in the software. Additionally a decoding tool was developed and incorporated for quality control purposes to check automatically the decoded description with the original one.

3.3. Other information

Within the "Greek Diet" Software an Access database (EFSAdatabaseCy) has been developed in order to be used for the data entry manually by the interviewers. The consumption data of the survey and the food coding were entered manually in the GreekDietDatabase and stored in 10 legacy MS Access databases connected in a central server located at SGL. Access to the data bases was given accordingly.

3.3.1. Questionnaires

Socio demographic information

A questionnaire retrieving information for socio economic status was used, including information on participant's gender and date of birth (Annex C). Information also included the participant's educational level, professional qualification, current professional status (employed/unemployed etc.) and family income.

Physical activity

The level of physical activity of the people participating in the survey was measured using the short IPAQ.

3.3.2. Measurement of body weight and height

The method used to assess height for all participants from 10 until 74 years of age was standing height with a stadiometer in cm. As equipment the telescopic height measuring instrument SECA 225 Height Rod was used Range = 2-230cm, Graduation = 1mm height. All participants were measured without shoes, and any hair ornaments that may interfere with the reliability of measurements were removed. Objective measurements of weight were taken using the scale TANITA BC 420 MA (Body Composition Analyser) in Kgs. Accuracy ± 0.1 Kg, Min=2Kg, Max=270Kg

3.3.3. Food supplements

- Information was collected using an extensive list of all possible supplements that participants were consuming via the diet questionnaire (Annex B) (during the previous 12 months) and
- Information was also collected via the 24hour recall method reporting the nutrient (s) that the supplement contains, and/ or the brand name were recorded along with the quantity consumed.

Concerning the "vulnerable" population of LOT 2 (pregnant women and adolescents) preliminary analysis of the diet questionnaire revealed that a) among pregnant women 67% took multivitamins, 25% took calcium, 53% took folic acid and 47% took iron supplement during pregnancy and b) 67% of adolescents reported having different types of supplements in the previous months.

4. Administration of the interview

4.1. Selecting the examination site

Home visits for the first interview took place. The participants were motivated to visit Research and Educational Institute of Child Health offices for the rest of the interviews; otherwise telephone interviews as proposed took place.

For the pregnant women, the selection was conducted through lists of public hospitals/ private sectors paediatricians/ obstetrician, so the first visit was arranged at their home (or with a visit to the Institute's headquarters, if inconvenient). The second interview was carried out either a face to face home visit (again) or via a telephone recall.

4.2. Content and organization of the study visits

4.2.1. First contact

According to the stratified sampling technique described above, pregnant women and adolescents were selected through lists of public hospitals, private sectors paediatricians and obstetricians and schools. Invitation letters were sent to selected individuals to arrange the first visit. The remaining participants were selected through postal codes so fieldwork staff carried out an unmodified home visit.

4.2.2. First interview

Since the participant accepted participation, interviewers filled in all the questionnaires. Priority was given to anthropometry and the 24h dietary recall. If there was not enough time, the rest of the questionnaires were not filled in. The first interview was performed at the participants' home. Participants were informed that a second interview would follow and were asked to report if they preferred a second home visit or a telephone recall. They were not aware of the date of the second interview except if the participant asked to know. The first interview included a 24h dietary recall performed at the participants' home.

4.2.3. Second interview

The second interview was either a second face to face or telephone 24h dietary recall. In case during the first visit there was not enough time to fill in all the questionnaires, this could be done during the second visit. After the second interview dietitians would make sure to get back to the participant via telephone/ email to report their results (Mediterranean Diet Score, IPAQ score etc.).

4.2.4. Interviewing and checking questionnaires

During the first interview fieldwork staff collected the following data in the following order:

- a) response questionnaire (Annex A); this is where basic information was captured such as address, sex, area of living, age, birth date, reason of not participating (in case of refusal)
- b) anthropometry
- c) Exact 24h dietary recall
- d) Food Frequency questionnaire (Annex E & F)
- e) Sociodemographic questionnaire (Annex C)
- f) IPAQ (Annex D)

After the completion of the first 24 recall, in case the participant did not wish to participate any further (usually due to the long time required), he/she was not contacted for a second interview therefore he/ she needed to be replaced by a new participant in the corresponding age group and were reported as drop outs – see table 12 in section 2.5.

4.3. Recruitment and training of the staff

4.3.1. Selection of the fieldwork staff

The fieldwork and the collection of data was carried out by ten experienced state registered dietitians/ nutritionists assessed by the Research and Education Institute of Child Health (REF). More specifically there was an interview for the job after a call to the Cyprus Dietetic Association. The criteria for recruitment were the following: a) experience, b) accepted flexible working hours, c) pleasant/ polite character. Dietitians came from all districts so that they wouldn't have to travel long distances (except from Paphos, because of no interest- Limassol's dietitians covered Paphos' population).

The coding of foods according to the food classification and description system FoodEx2 was carried out by trained scientists from the State General Laboratory (SGL).

4.3.2. Training

Four extensive trainings and relevant presentations were conducted:

1. Training of registered dietitians/ nutritionists: on interviewing, diet recalls/records methodology, anthropometry and other procedures according to survey requirements. Duration 20 hours;
2. Training of registered dietitians/ nutritionists: on the use of the two software packages that were built/ upgraded for this survey Access-EFSAdatabaseCy and GreekDietDatabase. The EFSAdatabaseCY was for data regarding a) Demographic data, b) Anthropometry, c) Smoking habits, d) Physical Activity questionnaire (Short IPAQ), and e) Food Frequency Questionnaire and the GreekDietDatabase was for the data of two days diet recalls from participants. Duration 20 hours;

3. Training of SGL personnel on the FoodEx2 Browser classification and coding system. Duration 2 days with the participation of EFSA expert;
4. Training on the coding within the GreekDietDatabase. Duration 20 hours (either at SGL or EFSA);
5. Presentations (conducted by SGL) on how EFSA carries out risk assessment and risk communication in order to ensure EU's food safety and how EFSA has developed the standardized food classification and description system FoodEx2. Duration 16 hours.

5. Quality assurance

During the implementation of the project various measures were taken at each level to assure the quality of the data produced. These measures are the following:

During Sampling:

- During the interview dietitians were trained to ask and record questions like water consumption, snacks, gums etc and then entered all the information in the "Greek Diet" Software;
- Well-trained interviewers/dietitians were conducting face-to-face home visits and telephone interviews and they were monitored on a regular basis to ensure that they were handing out instructions correctly and gathering all the necessary detailed information EFSA required from the dietary records;
- Field workers/ dietitians were extensively trained in order to be able to accurately carry out the data entry into the "Greek Diet" software. They were routinely monitored and checked so as to ensure the quality of the data they collect by a registered dietitian and nutritionist of REF;
- Regular manual checks on whether the information collected on the description /quantities of foods are satisfactory;
- Each interviewer had a unique password and identification for his/her access to data entry.

During Data entry:

- Manual checks on the energy intake of subjects per day based on the energy values of foods. Double check on the entries that sum up to a daily calorie intake of <500 kcal or >4000 kcal;
- Max portion tool. Error messages appear on the software if information on quantities reported were not reasonable. A new application (max portion tool) had been incorporated on the GreekDietDatabase, where if quantities appear to be unreasonable a question pops up: "Is this the right amount?".

During Food coding:

- Regularly logging into the DMS for any changes/updates on the FoodEx2 tool;
- Attending any relevant trainings on FoodEx2 coding organized by EFSA;
- Following continuously EFSA's requirements for the transmission of the data;
- Checking the food data coding in the GreekDietDatabase automatically through a decoding tool developed by SGL and incorporated into the GreekDietDatabase by the REF in order to check the decoded description with the original descriptions. This is a tool built specifically to handle the 10 legacy MS Access databases used in the survey;
- All the data was stored remotely in a central server at the SGL. The server was under continuous inspection by the IT of the SGL together with the IT of the REF.

6. Data management

- The participation of the individuals involved in the survey was on a voluntary basis and all the collected information is confidential with the permission of the national bioethics committee in Cyprus;
- The personnel involved in the survey are obliged by the law for the protection personal data;
- Every user of the "Greek Diet "Software had a personal identification and password with different level of access and each participant was assigned a unique code number;
- All the collected information was entered into 10 legacy MS Access databases, which were connected online to a hosting central server;
- In case of unrealistic food consumption data and any outliers in the energy, participants were asked to clarify if the amount(s) of food(s) was correct; if not he/she would be asked to report their usual amount of consumption in case of not being able to recall the true amount of food;
- The food items were classified and coded according to FoodEx2 in the GreekDietDatabase;
- For the final transmission to EFSA, the data files were converted in xml format according to "EFSA Data Transmission schema".

7. Dissemination and publicity

Initially a brochure, containing simple but comprehensive information regarding the project, had been prepared and disseminated both in Greek and English, in order to inform people of what was expected. The same material was enclosed in utility bills (i.e. Cyprus Electricity Authority bills), so that every household received the information before hand, in order to increase project awareness.

Information about the progress of the project was continuously uploaded in the websites of the State General Laboratory and the Ministry of Health, as well as in newspapers and TV programs.

The Cyprus Dietary Survey for adolescents and adults was presented at several conferences.

Both the SGL and REF, as owners of the collected data and supporters of public health research, will ensure that the outputs from the survey will be used to maximise knowledge and potential health benefits at national level. It is expected that upon completion of the evaluation of the data, all the outputs will be disseminated accordingly with presentations and publications.

The availability of the data to other institutions will be bound by terms of use. Data sharing with other institutions is subject to data governance standard operation procedure of SGL and REF. On the basis of this procedure, any institute, at national or international level, interested in obtaining the survey data, must proceed in a written request to SGL and REF in order to obtain the official approval of both data owners for data release. Any unauthorised use of the survey data is considered to be illegal.

8. Special issues/challenges

Issues that were confronted with the proposed methodology include the following:

- The task of the survey methodology was undertaken by the REF due to their extensive experience in dietary surveys in Cyprus (i.e. EXPOCHI EFSA Art 36 project). In order to determine any potential problems and assess the quality of instruments that were planned to be used, a pilot study was carried out in July 2014 by the REF. Twenty one participants, two pregnant women, five adolescents 10-17 years old, 12 adults 18-64 years old and two elderly 65-74 years old, were recruited for the pilot study. The pilot study was carried out by the trained staff of the REF according to the protocol;
- The pilot phase was useful. Minor problems were easily addressed i.e. rephrasing a term or a question, so it could be easily understood. Average 60 ± 15 minutes was the duration of the

first visit. Twenty-four-hour dietary recall took around 30-40 minutes. Both databases in the "Greek Diet" Software worked out as expected;

- However continuous updating and upgrading was needed for the "Greek Diet" Software in order to accommodate in the GreekDietDatabase the FoodEx2 coding as well as the composite dishes and the recipes – after disaggregation – for coding purposes. Additionally, the in-house decoding FoodEx2 was also incorporated in;
- The number of dieticians/fieldworkers had to be raised to ten in order to cover the whole of the freely-accessible areas of Cyprus, and further training/control was needed;
- To ensure an adequate response rate feedback was given on weight, height, lipid profile. In addition, feedback was given for the FPQ that was easily comprehensible by the participants as well as their energy expenditure as reported by the IPAQ questionnaire (low, medium, high activity);
- In order to achieve the envisaged number of 260 subjects in each age-group required in the project, 300 subjects in each age group were invited (i.e. invite 115% of valid subjects);
- The Cyprus team had to undertake several measures in order to achieve adequate response rate. Among others blood tests free of charge were offered to the participants and all the members of their family;
- The task of FoodEx2 coding and data transmission to EFSA was implemented by SGL, due to the fact that SGL had already carried out the FoodEx2 pilot project and had established procedure for sending data electronically to EFSA according to specific requirements;
- However mandatory information according to FoodEx2 was not always collected and the personnel working on FoodEx2 coding faced difficulties in order to capture to the highest degree the food description system (packaging, cooking, flavor, brand name etc.);
- More people have been trained on FoodEx2 coding to cover the high number of data due to the disaggregation of the recipes;
- Further challenge was the disaggregation of the recipes into their ingredients and the conversion with a yield factor to the cooked ingredients. This was successfully anticipated using an in-house MS excel electronic recipe database for the disaggregation and conversion. The disaggregated recipes were then incorporated into the 'GreekDietDatabase software and FoodEx2 coding and classification of all the ingredients raw and cooked was carried out.

Conclusions

The National Dietary Survey of the Cypriot adult population is the first harmonised survey according to EFSA's requirements. It captures the food consumption and eating habits of the Cypriots in a harmonized way so as to carry out more accurate, comparable and refined dietary exposure assessments to chemicals or nutrients.

The two objectives of the project (a) the preparation of a methodology for the food consumption survey in Cyprus for adults aged 10-74, according to the EFSA Guidance and (b) the description of the collected data according to EFSA FoodEx2 food classification system have been successfully accomplished within the agreed timeframe.

The response rate achieved was relatively low (47%) due to the low interest by the participants and the time effort required by them. However, the participation rate is quite high 99%.

For pregnant women the response rate was 98% and the participation rate 90%.

The percentage of non-responders and drop-outs were very low 0,2% and 0,9% respectively for the adult population and 0.5 and 1.9% respectively for pregnant women.

The previous experience of the REF in conducting similar but less demanding food consumption surveys proved very important in the successful design, management and implementation of the most important part of the survey that was the field work, since experienced and well trained interviewers dietitians had to conduct the necessary dietary recalls. All the necessary data for the survey was collected with the use of accurate tools such as precision scales and a validated picture book, for the determination of the portion sizes, tested in pilot scale questionnaires etc.

Furthermore, the previous experience of the SGL in the preparation and transmission of data to EFSA proved very valuable in the transmission of the survey food consumption data to EFSA

The "GreekDietDataBase" software was used as the dietary recall data entry and for the FoodEx2 coding.

The Cyprus partners in this project, the SGL and REF, have gained a lot of experience in the harmonisation methodology concerning the food classification and coding system required by EFSA. The benefits and the experience gained exceeded the problems faced during the project.

- The "Greek Diet" Software has been upgraded according to EFSA specifications for harmonized dietary surveys;
- A lot of experience was gained on the use of the FoodEx2 coding system, needed for the harmonization procedure in carrying out future dietary risk assessments at European level;
- The in-house decoding tool for the FoodEx2 is a tool built specifically to handle the 10 legacy MS Access databases, but the concept of decoding, validation and the subsequent XML generation can inspire future projects;
- If EFSA plans to continue collecting consumption data, perhaps a single, web-based data collection system can be collaboratively designed by all countries, meeting everybody's needs and allowing country specific customisation without changing the system's technical underpinnings.

From the evaluation of the findings of the survey, several useful conclusions are obtained on both the nutritional habits of Cypriot citizens (adolescents (10-17 years old), the adults (18-64 years old) and the elderly (65-74 years old) as well as the pregnant women) and on other issues, such as their physical activity, the supplements intake etc. All the data collected will be used for nutritional studies, exposure assessment to chemicals and nutrients as well as nutritional policy and other studies.

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Abbreviations

CFM	Cyprus Food Museum
EFSA	European Food Safety Authority
EGFCD	Expert Group on Food Consumption Data
FFQ	Food Frequency Questionnaire
FoodEx2	Food classification and description system
HHF	Hellenic Health Foundation
IARC	International Agency for Research on Cancer
IPAQ	International Physical Activity Questionnaire
SGL	State General Laboratory
REF	Research and Education Institute of Child Health

Appendix A – CY Recipe Database

Methodology for conversion of raw ingredients into cooked ones using yield factors

According to the Guidance on EU Menu methodology (EFSA, 2014), «all self-made composite dishes should be disaggregated and described on the component/ingredient level “as purchased”/ “as ingredient”. The disaggregation should be based on information provided by the subject or if this is not possible by means of standard recipes».

Therefore, the composite dishes, as defined by EFSA, were disaggregated case by case and the recipes were disaggregated into their ingredients according to a standard recipe (either from the Cyprus Food Museum (CFM) or the Hellenic Health Foundation (HHF)).

After disaggregation, the raw ingredients were converted using a yield factor [1, 2, 3] to the cooked ingredient in relation to the cooking method specified by the recipe. The yield factors were expressed as the weight percentage change (either +ve e.g. 20% meaning an increase in the weight e.g. pasta, boiling, or -ve e.g. -15% meaning a reduction in the weight, e.g. burger, oven). If more than one cooking method was applied to the ingredient, a compounded yield factor was calculated using formula (1):

$$\text{Compounded Yield Factor} = (y1+y2+y1*y2) \quad (1)$$

For example, assuming cooking method 1: $y1=-15\%$, cooking method 2: $y2=-25\%$, then the compounded yield factor is -36.25% , meaning that the raw ingredient will lose 36.25% of its weight to the application of the two cooking methods.

The resulting weight of the cooked ingredient was then expressed per 100g of edible portion (*Amount of COOKED ingredient (g) per 100g edible portion*) using formula (2):

$$\text{Amount of COOKED ingredient (g) per 100g edible portion} = \frac{\text{Cooked ingredient (g)}}{\text{Total Cooked Recipe (g)}} * 100 \quad (2)$$

The results of (2) was then used to calculate the amount of COOKED FOOD consumed (for each ingredient) using formula (3) where the *Total Edible Portion* is the food portion stated by the consumer.

$$\text{COOKED FOOD} = \frac{(\text{Amount of COOKED ingredient (g) per 100g edible portion}) \times (\text{Total Edible Portion})}{100} \quad (3)$$

Moreover, the raw ingredient weight was also expressed per 100gr of edible portion (*Amount of RAW ingredient (g) per 100g edible portion*) using the formula (4):

$$\text{Amount of RAW ingredient (g) per 100g edible portion} = \frac{\text{Raw ingredient (g)}}{\text{Total Cooked Recipe (g)}} * 100 \quad (4)$$

The result from (3) was then used to calculate, using the yield factor, the amount of raw food consumed using formula (5):

$$\text{Amount of RAW FOOD} = \frac{\text{COOKED FOOD}}{(100+\text{Yield Factor})/100} \quad (5)$$

All the calculations were performed in an excel spreadsheet (see Figure 2). The resulting amounts were incorporated into the “Greek Diet” software for further processing.

For instance if the pastitsio portion consumed is 300gr, then the amount of the cooked ingredients of the pastitsio recipe sum up to the 300g (Figure 1, column Amount of COOKED ingredients). Then all the ingredients both raw and cooked with their resulting amounts were incorporated into the “Greek Diet” software for further processing and the final FoodEx2 [4] coding is shown in Figure 2 as it is extracted from the Consumption file submitted to EFSA.

Ingredients Ready to Cook (Raw)_EN	Base Recipe (in g)	Cooking method 1	Cooking method 2	% Weight Change 1	% Weight Change 2	Compound % Weight Change	Ingredients in Cooked Recipe (g)	Amount of COOKED ingredient (g) per 100g edible portion	Amount of RAW ingredient (g) per 100g edible portion	Amount of COOKED ingredients in 300 g	Amount of RAW ingredients in 300g
macaroni, spaghetti	500	boiled	oven	182	140	576.8	3384	62.3	9.2	187	28
pork mince	500	soft fried	baked	-47	-23	-59.19	204.05	3.8	9.2	11	28
tomato paste	15	sauteed/ fried	baked	-20	0	-20	12	0.2	0.3	1	1
parsley	40	sauteed	oven	0	0	0	40	0.7	0.7	2	2
cinnamon	2.5	sauteed		0		0	2.5	0.0	0.0	0	0
olive oil	190	sauteed		0		0	190	3.5	3.5	10	10
milk	1000	oven		0		0	1000	18.4	18.4	55	55
egg	290	boiled	oven	-10	-17	-25.3	216.63	4.0	5.3	12	16
flour	96			0		0	96	1.8	1.8	5	5
olive oil	200	oven		0		0	200	3.7	3.7	11	11
anari cheese	100	oven	oven	-5	-5	-9.75	90.25	1.7	1.8	5	6
								100.0	54.0	300	162

Figure 1: Example of calculations for a cooked food portion of 300gr of pastitsio

ORFOODCODE	AMOUNTRAW	FOODEXCODE	ENRECIPEDE	AMOUNTRECIP	FOODEXCODE	AMOUNTFCOOKED
1433	28	A007L#F28.A07GL\$F28.A07GX	Pastitsio	300	A040N	187
1421	28	A04AC#F28.A07GS\$F28.A07GX	Pastitsio	300	A040N	11
200	1	A00ZF#F28.A07GS\$F28.A07GX	Pastitsio	300	A040N	1
165	2	A00YE#F28.A07GS\$F28.A07GX	Pastitsio	300	A040N	2
458	0.1	A019V#F03.A06JD\$F28.A07GS\$F28.A07GX	Pastitsio	300	A040N	0.1
2	10	A037D#F28.A07GS\$F28.A07GX	Pastitsio	300	A040N	10
53	55	A02LY#F28.A07GL\$F28.A07GX	Pastitsio	300	A040N	55
757	16	A031G#F28.A07GJ\$F28.A07GX\$F28.A0CRL	Pastitsio	300	A040N	12
10	5	A003X#F28.A07GL	Pastitsio	300	A040N	5
2	11	A037D#F28.A07GL	Pastitsio	300	A040N	11
759	6	A02QV#F28.A07KJ\$F28.A07GL\$F28.A07GX	Pastitsio	300	A040N	5

Figure 2: Extract (screenshot) from the Consumption file for the consumption of 300gr of pastitsio

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Annex A – Response and Anthropometric measurement Questionnaire

Annex B – Diet Questionnaire

Annex C – Sociodemographic Questionnaire

Annex D – International Physical Activity Questionnaire

Annex E – Food Frequency Questionnaire_Adults, Elderly and Pregnant Women

Annex F – Food Frequency Questionnaire_Adolescents