National Adult Nutrition Survey (NANS) methodology

Ethical Approval

Ethical approval was obtained from the University College Cork Clinical Research Ethics Committee of the Cork Teaching Hospitals.

Sampling

The fieldwork phase was carried out between October 2008 and April 2010. Adults aged 18-90 years (740 males, 760 females) were recruited in the Republic of Ireland. Eligible respondents were adults aged 18 years and over who were free-living and who were not pregnant or breast feeding.

Respondent recruitment

A sample of adults was randomly selected from a database of names and addresses held by Data Ireland (An Post). An introductory letter and information leaflet were posted to each person selected from the database. A researcher called to potential respondents’ homes to introduce the survey and invite participation. If the individual agreed to participate, a consent form was signed and the survey commenced. If the person was not at home, the researcher called on three more occasions on different days and at different times, before deeming them ineligible. For groups that were not highly represented in the database, particularly 18-35 year olds, a second level of recruitment was introduced. A second database of names and addresses was compiled through referrals from respondents and participation was invited for those that were contactable. The final
response rate for the survey was 60%. Analysis of the demographic features in this sample has shown it to be a representative sample of Irish adults with respect to age, gender, social class and geographical location when compared to census data (Central Statistics Office, 2007).

**Food intake data collection**

A four-day food diary was used to collect food and beverage intake data. The researcher made three visits to the respondent during the four-day period: a training visit to demonstrate how to keep the food diary and how to use the weighing scales; a second visit 24-36 hours into the recording period to review the diary, check for completeness and clarify details regarding specific food descriptors and quantities; and a final visit one or two days after the recording period to check the last days and to collect the diary.

Respondents were asked to record detailed information regarding the amount and types of all foods, beverages and nutritional supplements consumed over the recording period and where applicable, the cooking methods used, brand names of the foods consumed and details of recipes. Data were also collected on the time of each eating or drinking occasion, the respondent’s definition of each eating or drinking occasion (e.g. morning snack, lunch) and the location of the preparation of the meal or snack consumed (e.g. home, takeaway).
**Food quantification and coding**

A quantification protocol that had been established by the IUNA for the North/South Ireland Food Consumption Survey (NSIFCS) (Harrington *et al.*, 2001) was updated for the NANS. It is summarised as follows:

(1) *Weighed by respondent/manufacturer weights* - A portable food scales (Tanita, Japan) was given to each respondent. The researcher gave detailed instructions (including a demonstration) as to how to use the food scales during the training session. This method was used to quantify 46% of foods and drinks consumed. A further 10% of weights were derived from manufacturer's weights. To facilitate collection of such data, researchers asked respondents to collect all packaging of food and beverages consumed in a storage bag provided.

(2) *Food Atlas* - A photographic food atlas (Nelson *et al.*, 1997) was used to quantify 16% of foods and beverages consumed.

(3) *IUNA Weights* - Average portion weights that had been ascertained for certain foods by the IUNA survey team were used. This method was used to quantify 4% of foods and beverages consumed.

(4) *Food Portion Sizes* - “Food Portion Sizes” (Ministry of Agriculture, Fisheries and Food, 1997) was used to quantify 11% of foods and beverages consumed.

(5) *Household Measures* - Measures such as teaspoon, tablespoon, pint etc. were used to quantify 11% of foods and beverages consumed.

(6) *Estimated* - Food quantities were defined as estimated if the researcher made an estimate of the amount likely to have been consumed based on their knowledge of the
respondent’s general eating habits as observed during the recording period. This method was used to quantify 2% of foods and beverages consumed.

**Nutrient composition of foods and estimation of nutrient intake**

Food intake data were analysed using WISP© (Tinuviel Software, Anglesey, UK). WISP© uses data from McCance and Widdowson’s The Composition of Foods, sixth (Food Standards Agency, 2002) and fifth (Holland et al., 1995) editions plus all nine supplemental volumes (Holland et al., 1988; Holland et al., 1989; Holland et al., 1991; Holland et al., 1992; Holland et al., 1993; Chan et al., 1994; Chan et al., 1995; Chan et al., 1996; Holland et al., 1996) to generate nutrient intake data. During the NANS, modifications were made to the food composition database to include recipes of composite dishes, nutritional supplements, generic Irish foods that were commonly consumed and new foods on the market. All previous modifications to the food composition database were also checked and updated from current manufacturers’ information as necessary. The above modifications and additions comprise ‘The Irish Food Composition Database’ (Black et al., 2011).

**Questionnaires**

Four questionnaires were completed by the adults in the NANS. These included:

*Health and Lifestyle Questionnaire*: This questionnaire collected information on the respondent’s socio-demographics, education levels, attitudes to their own diet and weight, sun exposure and supplement usage. Information on smoking status and alcohol intake was also collected in this questionnaire. In the case of
married/cohabiting couples, the higher social class and education level was assigned to the respondent.

*Physical Activity*: Respondents completed a validated physical activity questionnaire (Epic Physical Activity Questionnaire (EPAQ2)) (Wareham *et al.* 2002) to assess customary levels of physical activity. The questionnaire consisted of three sections: activity at home, work and recreation.

*Food Choice Questionnaire*: This questionnaire was designed to find out information on food choice and the factors that can influence it, food neophobia and the respondent’s own opinion of their food preparation skills.

*Evaluation Questionnaire*: The researcher administered this questionnaire at the final visit to identify whether the respondent’s eating habits or physical activity patterns had been usual during the survey week. Medication usage was also recorded here.

Coded questionnaires were entered into the customised Q-Builder software package (Tinuviel Software, Anglesey, UK). A dual data entry method was used to enter questionnaires to ensure correct data entry.

*Anthropometry*

Anthropometric measurements were taken by the researcher in the respondents’ homes. Weight, height, waist and hip circumference and measures of body composition were recorded. Height was measured to the nearest 0.1cm using the Leicester portable height
measure (Chasmores Ltd, UK) with the respondent’s head positioned in the Frankfurt Plane.

Waist circumference was measured in duplicate using a non-stretch tape measure and taken at the naked site where possible. Waist circumference was measured at the midpoint to the nearest 0.1cm between the iliac crest (top of hip) and the bottom of the rib cage (10th rib). Hip circumference was measured in duplicate to the nearest 0.1cm using a non-stretch tape measure. This measurement was taken over light clothing at the widest part of the buttocks at the level of the greater trochanter (bony prominence of the thigh bone).

Weight and body composition were measured in duplicate using a Tanita body composition analyzer BC-420MA (Tanita Ltd, GB) to the nearest 0.1kg. Respondents were weighed after having voided, wearing light clothing and without shoes.

**Defining overweight and obesity in adults**

Body Mass Index (BMI) was used to indirectly assess adiposity and was calculated as weight (kg) divided by height squared (m$^2$). The World Health Organisation (WHO) BMI cut-off points were used to estimate levels of underweight (<18.5kg/m$^2$), normal weight (18.5-24.9kg/m$^2$), overweight (25.0-29.9kg/m$^2$) and obese (≥30 kg/m$^2$).

**Blood Pressure**

Blood pressure was measured in triplicate from the right arm where possible, leaving five minutes between each measurement. The measurement was taken with the respondent sitting on a well-supported chair, with feet placed firmly on the floor. Prior
to the measurement, respondents were asked to sit quietly without talking or laughing for at least five minutes. Respondents were asked to remove tight clothing from their upper arm and to rest their arm such that the antecubital fossa (triangular cavity of the elbow joint) was at the level of the heart, palm facing upwards. Measurements were taken in accordance with the manufacturer’s instructions for the OMRON M6 Comfort blood pressure monitor, with fieldworkers having received training in taking the measurement prior to fieldwork. Respondents were asked whether they had had anything to eat or drink (besides water) or whether they had smoked in the 30 minutes prior to the measurement. This information was recorded by the fieldworker. Respondents were informed of blood pressure readings that consistently fell outside of the normal ranges and advised to visit their health nurse or GP for another reading.

**Blood and Urine Collection and Analysis**

Participants were asked to provide a blood sample, fasting where possible, and a first void morning urine sample. Seventy-six per cent of respondents (n 1138) provided a blood sample of which 79% were fasting. A urine sample was collected from 75% of respondents (n 1121). The samples were collected by a qualified nurse at designated centres within the survey area or in the respondent’s home if the respondent could not travel.

In total, five tubes (45mls) of blood were collected from respondents and where appropriate, inverted gently to ensure thorough mixing with anti-coagulant. Of these, four were kept chilled and transported to the lab for further processing and storage, while the fifth was kept at room temperature for full blood count analysis. The blood
tubes collected were: 3 x serum tubes (total 26ml); 2 x EDTA tubes (total 13ml); 1 x lithium heparin tube (6ml).

A 50ml first void urine sample was also collected. Respondents were provided with a sterile collection tube to collect the urine sample on the final survey visit. They were also provided with an ice pack and asked to keep the sample chilled until they met with the nurse. Samples were kept on ice during transport to the lab for further processing.

A blood collection form was completed in which the following was recorded: date and time of blood collection, whether the respondent was fasting or not and any irregularities during blood collection. Written consent to take a blood and urine sample was obtained along with consent for the survey at the initial visit. Blood and urine samples were collected for the analysis of a number of markers of nutritional status and metabolic health. In line with good ethical practice, all samples were anonymised prior to analysis. Full details of the analytes measured will be available shortly on www.iuna.net. Furthermore, data collected in this project will also feed into a sister project, the “National Nutrition Phenotype Database” (Joint Irish Nutrigenomic Organisation (www.ucd.ie/jingo) for further analysis of markers of metabolic health.

Physical activity and accelerometer

A tri axial accelerometer (Actigraph GT1M, ActiGraph, LLC) was worn for the four days of the survey period. It was worn on the waist and reported acceleration using a proprietary unit – “counts”. An accelerometer diary was also used to track activities that are poorly recorded by accelerometers such as cycling and swimming and to record when the accelerometer was removed e.g. for sleeping/showering.
Quality control

A number of quality procedures were put in place in an attempt to minimise error and ensure consistency throughout the collection and manipulation of food intake data. Researchers received training that included role-play workshops prior to commencing fieldwork, where they were trained to take a natural and friendly approach to fieldwork and to avoid prompting foods. This was carried out in an attempt to make respondents feel at ease and so that the most reliable data possible could be obtained. It was stressed to respondents that they should not try to change or ‘improve’ their diet during the recording period. At the end of the recording period, respondents were asked whether their food intake had been the same as usual, less than usual or more than usual during the recording period and to explain why this might have been. Respondents were also asked whether they had been on a weight reducing or weight gain diet whilst taking part in the survey, and if there were any items consumed during the recording period which had not yet been written down. Details on such items were then recorded by the researcher in the food diary.

Each researcher was primarily responsible for the collection, quantification, coding and data entry of their own food diaries in an attempt to maintain consistency, and were provided with detailed guidelines regarding each task. WISP-DES© (the food data-entry system) was set up to incorporate over-range checks for portion sizes, by generating a warning if a food weight was entered as five times a typical ‘large’ portion size. Cut-off points based on basal metabolic rate were used to identify over and under-reporting of food intake, so that this could be taken into account during certain analyses (e.g., in estimating the prevalence of inadequate micronutrient intakes). Researchers were also asked to rate each respondent’s food diary as ‘accurate and complete’,.
‘inaccurate and complete’, ‘accurate and incomplete’ and ‘inaccurate and incomplete’ so that data quality could be considered during certain analyses.

A coding manual was developed for the questionnaires and all questionnaires were dual entered using customised questionnaire software (Q-Builder, Tinuviel Software, Anglesey, UK) which uses a rules based validation processes permitting answers from the coding manual only.

**Databases**

The food intake database from the NANS comprises 133,050 rows of data that describe each food and drink item consumed by the 1500 respondents at every eating occasion throughout the four recording days.

**Food Groupings**

Each of the 2552 food codes (including 233 supplements) consumed during the survey were assigned to one of 68 food groups (Appendix I) in the database and also further aggregated into 19 food groups (Appendix II).

**Data Manipulation**

Data manipulation was conducted using SPSS© Version 15.0 for Windows™ (SPSS Inc. Chicago, IL, USA).
**Statistical Analysis**

Variables were described using the mean, median, standard deviation and the 5\textsuperscript{th} and 95\textsuperscript{th} percentiles. Variables were tabulated for total population and split by gender and age group.

**Bibliography**


