

Methodology Used in the National Children's Food Survey

Sampling

The National Children's Food Survey (NCFS) is a cross-sectional study that was carried out between March 2003 and March 2004 by the nutrition units in University College Cork and Trinity College Dublin, which form part of the Irish Universities Nutrition Alliance (IUNA). Children aged 5-12 years (293 boys, 301 girls) were selected from 28 primary schools throughout the Republic of Ireland.

Selection of schools

Schools were selected from a database of primary schools obtained from the Department of Education and Science. All schools in the database that contained at least 8 students in each of the eight classes ($n=1194$ schools) were classified according to (a) size ('large' (more than 300 pupils), 'medium' (100 to 300 pupils) or 'small' (fewer than 100 pupils)) (b) gender served ('all boys', 'all girls' or 'mixed') (c) disadvantaged/ not disadvantaged and (d) location (urban or rural). A number of schools were randomly selected from each category (e.g. medium, mixed, not disadvantaged, urban), so that in the final sample, the percentage of children attending each of the categories of schools reflected the percentage of children attending each of the categories of schools according to the database. All urban schools selected were located in Cork or Dublin and all rural schools selected were located outside Cork or Dublin.

Respondent recruitment

An introductory letter and information about the survey was posted to the principal of each school selected. This was followed up by a phone call from the coordinating nutritionist. If the principal agreed to his/her school's participation in the survey, a suitable date and time for the coordinating nutritionist to visit the school was arranged. Over 90% of schools selected agreed to participate in the survey. The school principal was given detailed instructions to select children for participation in the survey. For example, if a sample of 16 boys and 16 girls was required, 2 boys and 2 girls would be needed from each class. In the case of first class with 12 boys and 16 girls, the principal

was instructed to select every 2nd boy ($n = 6$) and every 3rd girl ($n = 5$) from the school roll to ensure that two 7 year old boys and two 7 year old girls would be recruited from the class. The principal was instructed not to select more than one child from the same household. The principal was given an envelope, containing an introductory letter, an information brochure, and a reply slip to give to all selected children to bring home to their parents/guardians. If the parent/guardian and the selected child were interested in finding out more about participating in the survey they were instructed to fill out their contact details on the reply slip and return it to the school. Selected children who returned a reply slip were excluded if they were not between the ages of 5 and 12 years or if they belonged to an age/sex/location/socio-demographic category for which the appropriate number of children had already been recruited. A researcher in each centre contacted the parents/guardians of all eligible children who returned a reply slip and if they agreed to participate in the survey a suitable time and date for a fieldworker to visit was arranged. The overall response rate was 66% of the children selected from the schools. Analysis of the demographic features in this sample has shown it to be a representative sample of Irish children with respect to age, sex, social class, socio-economic group and geographical location when compared to the census data for children aged 15 years or younger (see further details in tables 2.7-2.9) The sample was also representative with respect to social class and education, however the sample had a higher proportion of third level educated compared to the recent census data from Ireland for 2002 (Central Statistics Office, 2003).

Data collection

A 7-day weighed food diary was used to collect food and beverage intake data. The researcher made four visits to the respondent and his/her parent/guardian during the 7 day period: a training visit to show 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; a third visit 4 or 5 days into the recording period to check the previous 2 or 3 days and to encourage completion; and a final visit 1 or 2 days after the recording period to check the last days and to collect the diary.

The respondents and/or their parents/guardians were asked to record detailed information regarding the amount and types of all foods, beverages and nutritional supplements consumed over the 7-day period and where applicable the cooking method used, the brand name of the food consumed, packaging size and type, who weighed the food/beverage, and details of recipes and any leftovers. Data was 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 etc.) and the location of the preparation or source of the meal or snack consumed (e.g. home, school, takeaway etc.).

Food quantification

A quantification protocol that had been established by the IUNA for the North/South Ireland Food Consumption Survey (NSIFCS) (Harrington *et al.*, 2001) was adapted for the NCFS.

- (1) *Weighing* - A portable food scales (Soehnle Vita (1000×1g)) was given to each respondent or parent/guardian. The fieldworker gave detailed instructions (including a demonstration) as to how to use the food scales to respondents and/or parents/guardians during the training session. Over 75% of foods and drinks consumed in the NCFS were weighed.
- (2) A *Photographic Food Atlas* (Nelson *et al.*, 1997) was used to quantify 5% of foods/beverages consumed.
- (3) *Manufacturer's Information* - Weights of over 10% of foods/beverages consumed were derived from weights printed on food packaging. To facilitate collection of such data, fieldworkers asked respondents to collect all packaging of food and beverages consumed in a storage box provided
- (4) *IUNA Information* - Average portions that had been ascertained for certain foods by the IUNA survey team for the NSIFCS were used. This method was used to quantify 1% of foods/beverages consumed.
- (5) *Food Portion Sizes* (Ministry of Agriculture, Fisheries and Food, 1997) was used to quantify 3% of foods /beverages consumed.
- (6) *Household Measures* e.g. teaspoon, tablespoon, pint etc. were used to quantify almost 2% of foods/beverages.

(7) *Estimated* - Food quantities were defined as estimated if the fieldworker made an assessment of the amount likely to have been consumed based on their knowledge of the respondents general eating habits observed during the recording period. Weights of 3% of foods/beverages consumed were estimated.

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 supplemental volumes (Chan *et al.*, 1996, Chan *et al.*, 1995, Chan *et al.*, 1994, Holland *et al.*, 1996, Holland *et al.*, 1993, Holland *et al.*, 1992, Holland *et al.*, 1991, Holland *et al.*, 1989 Holland *et al.*, 1988) to generate nutrient intake data. Both during the NSIFCS and the NCFS, modifications were made to the food composition database: 993 extra new foods were added during the NSIFCS and a further 564 foods were added during the NCFS. These included recipes of composite dishes, nutritional supplements, generic Irish foods that were commonly consumed and new foods on the market.

Questionnaires

In total the parents and children were asked to complete seven questionnaires.

Children's Health and Lifestyle Questionnaire: The parents completed this questionnaire, which covered a broad range of details regarding the child, from birth weight and infant feeding practices to allergies, dieting practices, parent's attitudes to their child's diet, vitamin and supplement usage, and childminding.

Parent Health and Lifestyle: This questionnaire included information on socio-demographics, education level and attitudes of parents to their own diet. This questionnaire was administered to both mother and father when possible. Social class and education level was recorded for each parent, and the higher code was entered to the database

Child's Questionnaire: A questionnaire was also administered to the older children, aged 9-12 years, in an attempt to identify the attitudes of the children in relation to food and health. The questionnaire was intended to be self administered by the child and therefore only targeted to the older children.

Physical Activity: Parents and children completed physical activity questionnaires to assess levels of customary physical activity. The questionnaires consisted of three sections: activity at home; work or school; and recreation. In the children's version of the questionnaire, the differences between school holidays and term time was also examined

Eating Behaviour: This questionnaire was completed by the parents and examined the eating behaviour of both the parents and children, including food neophobia and variety seeking behaviour of the respondents.

Evaluation Questionnaire: The fieldworker administered this questionnaire at the final visit. This identified whether the child's eating habits or physical activity patterns changed during the survey week.

Anthropometry

Weight, height, waist and hip circumference, and leg length, were measured for both children and their parents by qualified nutritionists. Weight was measured in duplicate using a Seca 770 digital personal weighing scale (Chasmores Ltd, UK), to the nearest 0.1kg. Respondents were weighed whilst wearing light clothing, without shoes and after voiding. 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. Firstly, the iliac crest (top of hip) and the bottom of the rib cage (10th rib) were identified and marked. Waist circumference was then measured at the midpoint, to the nearest 0.1cm. Hip circumference was measured again 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. Leg length was measured in duplicate to the nearest 0.1cm, using a non-stretch tape measure. The respondent was in a standing position with legs straight, placed symmetrically and with the pelvis square. The measurement was taken on the left leg, from the anterior superior iliac spine to the distal tip of the lateral malleolus (ankle).

Defining overweight and obesity in children

Body Mass Index (BMI) was used to indirectly assess adiposity and was calculated by weight (kg) divided by height squared (m^2). Age-and-sex-specific BMI charts were used to determine the prevalence of overweight and obesity in this sample of Irish children. These BMI charts are used to compare a child's BMI to the BMI distribution of a reference sample of children of the same age (Flegal *et al.*, 2002). Due to the absence of age-and-sex-specific BMI charts for an Irish reference population, the UK 1990 BMI reference curves for boys and girls (UK90) were used (Cole *et al.*, 1995). In addition, the International Obesity Task Force (IOTF) age-and-sex-specific BMI cut-offs for defining overweight and obesity between 2-18 years were also used so that international comparisons could be made (Cole *et al.*, 2000).

Physical activity and accelerometer

Each child wore an accelerometer for 4 days of the survey period, usually 2 weekdays and 2 weekend days (RT3 Tri-axial accelerometer, Stayhealthy.com). The RT3 is the size of a pager and is worn on the waist. It continuously tracks activity through the use of piezo-electric accelerometer technology that measures motion in three dimensions and provides tri-axial vector data in activity units, metabolic equivalent units (METs) or kilocalories. The Stayhealthy software and RT3 docking station was used to upload the data from the accelerometer into an excel spreadsheet for each subject. One of the disadvantages of most accelerometers is the inability to record motion while the subject is cycling, bathing or swimming. Therefore the time spent at these activities was recorded in an accelerometer diary.

Quality control

A detailed quality control protocol was developed for both food consumption and questionnaire data coding and entry to ensure consistency and compatibility between the two centres. For the food consumption data, a number of quality procedures were implemented, including detailed quantification and coding guidelines, default food codes and computerised limits for data entry. Each fieldworker entered data from the diaries that she had collected, and each diary was checked on a line-by-line basis on completion. Twenty per cent of all diaries were rechecked by a different field worker.

A detailed coding manual was also developed for the questionnaires, and all questionnaires were assimilated using customised questionnaire software (Q-Builder, Tinuviel Software, Anglesey, UK). Dual data-entry was carried out to ensure quality, and rules based validation processes, where only the answers from the coding manual are permitted, were implemented. The consolidated data was exported as an ASCII comma-delimited file for import to SPSS. Once imported into SPSS, all of the databases were analysed for errors and outliers

Databases

The food intake database from the NCFS comprises of approximately 72,000 rows of data that describe every food and drink item consumed by each of the respondents, at every eating occasion, for each of the seven recording days. For each item consumed, the database records the actual day of the week and meal number in the day, the definition of the eating occasion, the time and location of consumption, the weight of food/drink consumed, the brand information, packaging type and packaging size, and a full nutrient breakdown for the amount of food consumed. Each food was assigned to one of 144 food groups in the database. For the purposes of the present study, these food groups were reduced to 19 groups and this database can be aggregated to examine day by day intakes and mean daily intakes of foods and nutrients

References

Central Statistics Office (CSO). *Census 2002 Principal Demographic Results*. Dublin: The Stationery Office, 2003.

Chan W, Brown J, Buss DH. *Miscellaneous Foods. Fourth Supplement to McCance & Widdowson's The Composition of Foods*, 5th ed. London: HMSO, 1994.

Chan W, Brown J, Church SM, Buss DH. *Meat Products and Dishes. Sixth Supplement to McCance & Widdowson's The Composition of Foods*, 5th ed. London: HMSO, 1996.

Chan W, Brown J, Lee SJ, Buss DH. *Meat, Poultry and Game. Fifth Supplement to McCance & Widdowson's The Composition of Foods*, 5th ed. London: HMSO, 1995.

Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal* 2000; **320**: 1240-1243.

Cole TJ, Freeman JV, Preece MA. Body mass index reference curves for the UK, 1990. *Archives of Disease in Childhood* 1995; **73**: 25-29.

Flegal KM, Wei R, Ogden C. Weight-for-stature compared with body mass index-for-age growth charts for the United States from the Centers for Disease Control and Prevention. *American Journal of Clinical Nutrition* 2002; **75**: 761-766.

Food Standards Agency. *McCance and Widdowson's The Composition of Foods, Sixth summary edition*. Cambridge: Royal Society of Chemistry, 2002.

Harrington KE, Robson PJ, Kiely M, Livingstone MBE, Lambe J, Gibney MJ. The North/South Ireland Food Consumption Survey: survey design and methodology. *Public Health Nutrition*. 2001; **4**: 1037-1042.

Holland B, Brown J, Buss DH. *Fish and Fish Products. Third Supplement to McCance & Widdowson's The Composition of Foods*, 5th ed. London: HMSO, 1993.

Holland B, Unwin ID, Buss DH. *Cereal and Cereal Products. Third Supplement to McCance & Widdowson's The Composition of Foods*, 4th ed. London: HMSO, 1988.

Holland B, Unwin ID, Buss DH. *Fruits and Nuts. First Supplement to McCance & Widdowson's The Composition of Foods*, 5th ed. London: HMSO, 1992.

Holland B, Unwin ID, Buss DH. *Milk Products and Eggs. Fourth Supplement to McCance & Widdowson's The Composition of Foods*, 4th ed. London: HMSO, 1989.

Holland B, Unwin ID, Buss DH. *Vegetables, Herbs and Spices. Fifth Supplement to McCance & Widdowson's The Composition of Foods*, 4 ed. London: HMSO, 1991.

Holland B, Welch AA, Buss DH. *Vegetable Dishes. Second Supplement to McCance & Widdowson's The Composition of Foods*, 5th ed. London: HMSO, 1996.

Holland B, Welch AA, Unwin ID, Buss DH, Paul AA, Southgate DAT. *McCance & Widdowson's The Composition of Foods*, 5th ed. London: HMSO, 1995.

Ministry of Agriculture, Fisheries and Food. *Food portion sizes*. London: The Stationery Office, 1997.

Nelson M, Atkinson M, Meyer J. *A photographic atlas of food portion sizes*. England: Food Standards Agency, 1997.