

# Appendix A Dietary data collection and editing for Year 10 and 11 of the NDNS RP

## A.1 Introduction

This appendix provides an overview of the methodology of dietary data collection and editing for Years 10 (2017/18) and 11 (2018/19) of the NDNS RP. The methodology outlined in this appendix is consistent with Year 9 (2016/17) unless stated otherwise. Detail of the methodology for previous years can be found in appendix A of the Years 1 to 9 report.<sup>1</sup>

## A.2 Method

For Years 10 and 11 of the NDNS RP, a 4-day estimated food diary was used. Several versions of the food diary were developed for different age groups:

- an A5 diary for adults – also available in A4 size for those with vision or writing difficulties
- an A4 diary for children
- an A5 diary for toddlers to be completed by adults

Each version included example pages appropriate to the age group to show how to complete the food diary and how much detail to include. For children aged 11 years or younger, a parent/carer was asked to complete the 4-day food diary with input from the child as appropriate. Children aged 12 years and older were asked to complete the diary themselves with details confirmed with others where necessary. Participants were asked to record all food and drinks consumed both at home and away from home and were therefore asked to take the diary with them when away from home. For young children who regularly consume meals away from home, a carer pack was issued which consisted of 4 separate recording sheets and an information leaflet. A teacher, childminder or friend's parent, for example, might then complete parts of the diary for the child.

Interviewers undertook 3 visits with each participant. At the first visit, the interviewer placed the food diary. The second was a brief visit to check for compliance, answer questions or deal with problems and review the diary to identify and edit possible omissions and missing detail. In certain circumstances, a telephone call could be made in place of a home visit. The third visit was to collect the diary and again review and edit possible omissions. This final visit took place no later than 3 days after the last diary day.

Participants were asked to keep a record of everything eaten or drunk over 4 consecutive days. If a household contained 2 participants, both participants were assigned the same

diary days for convenience. When placing the diary, interviewers followed a set protocol to explain the method, taking participants through the different diary sections including the instruction page, how to describe details of food and drink and portion sizes and an example day. The adult diary provided photographs of 10 frequently consumed foods as small, medium and large portion sizes which participants could use for identical or similar foods. Otherwise they were asked to record portion sizes in household measures (e.g. 1 tablespoon of baked beans, 1 Kit Kat (2 fingers)), or for packaged foods to note the weight indicated on the packet.

The child and toddler diaries did not include photographs of foods so all portion sizes were recorded by the child or their parent in household measures or weights from packaging. To improve the accuracy of the estimation of portion sizes for children, a food photograph atlas designed specifically for interviewers to use with young people was introduced into the NDNS RP for use with those aged under 16 years. Further details are available in the Years 1 to 9 report.<sup>1</sup> Ten different foods were included in the atlas with the majority displayed using 7 'as served' portions and 7 'leftover' portions (table A.1). Most photographs could be used to estimate amounts for other similar foods in addition to the actual foods shown e.g. rice could also be used for couscous. These alternatives were listed on a separate card - the Equivalent Foods List (EFL). While keeping the food diary, participants were instructed to record portion sizes in household measures as usual. At the second and third visit the interviewer used an age-appropriate atlas when reviewing the diary, asking the participant or their parent to select photos for any food that appeared in the atlas or on the EFL. The photo reference numbers were then written in the diary by the interviewer alongside the original household measure. Interviewers did not query the photo chosen, even if it appeared to conflict with the household measure, but they could comment in an evaluation form if they had any concerns.

**Table A.1 List of foods in the food photograph atlas**

Rice krispies	Baked beans
Cornflakes	Broccoli, boiled
Rice	Carrots
Pasta (no sauce)	Peas
Cheddar cheese	Chips

Leftovers were not recorded separately in the diaries; participants were asked to take leftovers into account when recording how much they consumed. As a prompt for this, a question at the end of each diary day asked participants whether they had finished all the food and drink they recorded that day. Leftovers tend to be more common with children and so each food in the food photograph atlas had a set of leftovers photos. Participants or their parent were asked to select 1 photo for the amount 'served' and 1 for the amount 'leftover'.

Participants were asked to record brand names for foods wherever possible and to collect the food label information/wrappers for any unusual foods and ready meals consumed to

help coders identify or clarify items. For homemade dishes, participants were asked to record on a separate page in the diary the individual ingredients and quantities for the whole dish along with a brief description of the cooking method and how much of the dish they had consumed.

In addition to details of what and how much was eaten, participants were asked to record the eating context for each eating occasion: where they were, who they were eating with, whether they were watching TV, and/or sitting at a table. After each day, diary questions prompted participants to record if their intake was typical for that day (and if not, the reason why) and details of any dietary supplements taken. The diary also contained a series of questions about usual eating habits (for example, type of milk or fat spread usually consumed) to facilitate coding in cases where details were omitted in the diet record.

### **A.3 Dietary data processing**

Diaries were returned for coding to the Medical Research Council Elsie Widdowson Laboratory (MRC EWL) in Year 10 and the MRC Epidemiology Unit in Year 11. For both years, food intakes were entered into the MRC EWL's dietary assessment system DINO (Diet In Nutrients Out), an all-in-one dietary recording and analysis system written in Microsoft Access.<sup>2</sup> The food composition data used was Public Health England (PHE)'s NDNS Nutrient Databank (NDB); this was incorporated into the DINO system. Coders attempted to match each food or drink item recorded in the diary with a food code and a portion code from DINO (sourced from the NDB). For composite items which could be split into their component parts, for example sandwiches, each individual component was assigned a food and portion code. If an item had been recorded and there was no suitable code in DINO or if there was insufficient detail to code the food, the entry was flagged as a query.

Within DINO, each food code is linked to appropriate portion size descriptors, such as a tablespoon for rice or pasta, which are then linked to an assigned weight for that descriptor. So if a participant described their food using household measures, coders would be automatically able to select the appropriate portion size descriptor. If the portion size was described as a weight in the diary, the weight would be entered directly into DINO in grams.

Where manufactured products were reported in the diary, such as ready meals, confectionery, crisps etc portion weights were taken from manufacturer or retailer websites. A similar approach was used for items reported as consumed from fast food and similar outlets. The Food Standards Agency (FSA) Food Portion Sizes book<sup>3</sup> provided weights for unprocessed foods such as fruit and vegetables and a reference for manufactured items when no other data was available. It also provided weights for small, medium and large portions of typical dishes for adults. For children, age-appropriate portions were used based on the analysis of portion sizes consumed in previous NDNS which were collected using weighed records.<sup>4</sup> For foods consumed at primary and secondary school, portion sizes were taken from data collected from school meal surveys.<sup>5</sup> If necessary, a food would be purchased and weighed. If portion sizes were missing, the entry was flagged as a query.

For children, if a photo reference atlas number had been recorded in the diary alongside the household measure, the coder looked up the corresponding weight in grams of the food in the photograph and also entered this weight into DINO. If a food item had both an atlas and non-atlas (i.e. from a household measure) weight, the atlas weight was used to calculate food consumption and nutrient intake data providing a photograph had been selected that matched the food or was on the EFL. Coders checked all atlas entries in the diary to ensure that an age-appropriate atlas had been used and that a suitable photograph had been selected.

Where the coder could not resolve the food or portion consumed, the entry was flagged as a query for action by an editor who had greater nutrition knowledge and experience. The editors assigned appropriate codes for all flagged food and portion codes and checked any other queries raised by the coders. In general, where details for the coding of foods were missing, formally agreed default codes were used, such as for the type of milk in tea or coffee in a café, or lasagne eaten at a restaurant. Where portion sizes were missing, an estimate was made using the same weight if the food was consumed on another dietary day, or a portion size consistent with the participant's usual consumption (e.g. small, medium or large), or an age-appropriate average portion.

For new products not in DINO, editors visited supermarkets, searched on websites or contacted the manufacturer to obtain information on nutrient content in order to decide whether a new food code was needed. This decision was based on nutritional composition compared to that of existing codes, as well as the frequency of consumption, and was made in conjunction with PHE. If a new food code was required, the nutrient content was entered into the NDB. If a portion was used but there was no corresponding portion code in DINO, a new portion code was created using either a weight from an equivalent food, or the food item was weighed and the weight entered into DINO for future use.

Where a participant consumed a homemade recipe, each individual food item was linked with the food group of the recipe. DINO has the capability to report on these foods both at the recipe level and food level, providing a clearer picture of consumption of components like meat, fish, fruit and vegetables.

For homemade dishes where a recipe had been recorded, the ingredients were entered individually using the appropriate cooked food codes, and all the codes for the dish were allocated to a recipe food group according to the type of dish. The weight of each cooked ingredient was calculated using the raw weights recorded by the participant, a weight change factor for the whole dish (from a comparable recipe in McCance and Widdowson's *The Composition of Foods series*<sup>6</sup>) and the weight of the portion consumed. Where the food was stated as homemade but there was no recipe given, a standard homemade recipe food code was chosen.

## **A.4 Quality control**

Staff were trained and provided standard operating procedures. Editors checked the first 10 diaries coded for each coder and gave them individual feedback on their work. Further training and feedback was provided if required. During the coding process, editors undertook a further 100% check of all food and portion code entries of one diary per coder for each fieldwork month. Portion code errors (selecting the wrong portion size descriptor in DINO or entering an incorrect weight) were more common than selecting the wrong food code. Where errors were found they were corrected. These checks ensured that error

rates were monitored ongoing for all coders working on the project and helped identify any coding issues.

During coding, all of the entries flagged as a query by the coders were categorised into 8 query types, such as food code or portion code not available in DINO, recipes, missing or insufficient detail to code food or portion (shown in table A.2). Overall the number of queries in Year 11 was approximately half the number in Year 10 due to a smaller, more experienced coding team.

**Table A.2 Types of diet diary query types raised by coders in Years 10 and 11**

Type of diet diary coding query	% of all queries	
	Year 10	Year 11
Food code not available in DINO	68	94
Portion code not available in DINO	12	3
Missing/insufficient detail to code portion	11	3
Missing/insufficient detail to code food: eaten away from home/prepared outside catering unit	4	0
Missing/insufficient detail to code food: NOT eaten away from home/prepared outside catering unit	4	0
Other: including queries related to non-nutrition fields such as place, who with etc.	0 <sup>a</sup>	0
Recipe - Missing ingredients/insufficient detail to code food	1	0
Recipe - Missing amounts	0	0

<sup>a</sup> <0.5%

At the end of coding and editing for each survey year, a series of data checking procedures were performed. Initial checks were carried out to highlight any missing data fields, such as incomplete eating context or nutrient variables, followed by a feasibility check of the maximum and minimum portion sizes entered within each subsidiary food group.<sup>i,1</sup> Final quality checking was performed by generating boxplot graphs plotting each participant's energy and nutrient intake (for all reported nutrients) for each day over the diary period. Boxplot graphs were split by age groups (1.5 to 3 years, 4 to 10 years, 11 to 18 years and 19 years and over). Extreme intakes were considered as more than 1.5xIQR (Inter-quartile range: 75<sup>th</sup> percentile-25<sup>th</sup> percentile) from the nearest quartile for that intake (either the 25<sup>th</sup> or 75<sup>th</sup> percentile) and were indicated on the boxplot graphs as individual data points separate from the box and whiskers. Lone extreme intakes were checked against the diary<sup>ii</sup>. Extreme intakes that were the result of errors in data entry or food

<sup>i</sup> Main and subsidiary NDNS food groups are listed in appendix R of the Years 1 to 9 report.

<sup>ii</sup> Due to remote working restrictions in place during the COVID-19 pandemic, it was not possible to check individual Year 11 diaries, so decisions were made based on other entries in DINO.

composition in the NDB were corrected, otherwise values were left in the dataset as they are assumed to reflect actual consumption by participants.

#### **A.4.1 Modifications to the NDNS Nutrient Databank (NDB)**

Details on the history of the NDB can be found in the Years 1 to 9 report.<sup>1</sup> For Year 10 the NDB was maintained by PHE and MRC EWL.<sup>iii</sup> For Year 11 the NDB was maintained by PHE and the National Institute of Health Research Biomedical Research Centre Diet, Anthropometry and Physical Activity Group (NIHR BRC DAPA) at the MRC Epidemiology Unit (University of Cambridge).

Each food on the NDB has values assigned for 54 nutrients and energy. The nutrient values assigned to the food codes are based on data from nutrient analysis of foods as well as nutritional information provided on food labels sourced for foods reported as consumed by NDNS RP participants. Where reliable information was not available for some nutrients, values for such foods were obtained by extrapolating from data for similar foods. For homemade dishes and manufactured products, nutrients were calculated from their constituents using a computer recipe program that allows adjustments to be made for weight and vitamin losses on cooking.

Each year a programme of updates and revisions are made to the NDB so that the databank is up-to-date and, as far as possible, reflects the nutrient composition of the food supply for each survey year reported. Updating of the NDB includes the addition of new foods as well as revision of nutrient composition of existing foods, either at food group level following a programme of reanalysis, or to take account of reformulation by manufacturers and changes in fortification practices. Therefore the same foods may have a different composition for some nutrients in 1 year of the RP compared to another year. Table A.3 summarises the updates to the NDB that have taken place for Years 10 and 11. Currently, the NDB contains over 5,500 foods and drinks, including manufactured products, homemade recipe dishes and dietary supplements.

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<sup>iii</sup> The MRC Elsie Widdowson Laboratory (MRC EWL) was previously called MRC Human Nutrition Research (MRC HNR). The Unit was closed at the end of December 2018 having been the scientific lead for the NDNS RP Years 1 to 10 (2008/09 – 2017/18).



**Table A.3 Updates to the NDB in NDNS RP Years 10 and 11**

Fieldwork year	Analytical data updates	Reviews of manufacturers'/label data
Year 10 (2017/2018)	None	Soft drinks Breakfast cereals Yogurt, fromage frais and other dairy desserts Buns, cakes, pastries and fruit pies Biscuits Puddings Preserves and sweet spreads Chocolate confectionery Ice cream
Year 11 (2018/2019)	None	Bread and rolls <sup>a</sup> Soup <sup>a</sup> Baked beans <sup>a</sup> Breakfast cereals Biscuits Crisps <sup>a</sup> Sugar confectionery Soft drinks Yoghurt, fromage frais and other dairy desserts

<sup>a</sup> Only sodium values updated

Following revision of government recommendations and definitions for sugars and fibre (SACN Carbohydrates report<sup>Error! Bookmark not defined.</sup> published in 2015), data for 2 new nutrient variables; free sugars and AOAC fibre were introduced into the NDB for Year 8 (2015/16) and were retrospectively calculated for all NDNS survey years dating back to Year 1, replacing NMES and NSP respectively. Details of the methodology for determining free sugars and AOAC fibre values in the NDNS RP are provided in appendix AA of the Years 1-9 report.<sup>1,7</sup>

#### A.4.2 Disaggregation of composite dishes

At the beginning of the RP the NDB contained many composite food codes, which comprised 2 or more ingredient components and related either to purchased or homemade dishes. For some food groups it is important to quantify those foods eaten as part of composite dishes, as well as their discrete portions, to provide more accurate estimates of total amounts consumed at an individual food level. For example, carrots may be eaten as an accompaniment to a main meal, but they may also be consumed as an ingredient within a stew, together with additional vegetables such as onions and celery. In order to determine the total intakes of fruit and vegetables, meats, and fish, a project was undertaken during Year 1 (2008/09) of the RP to retrospectively disaggregate all pre-existing food codes in the NDB.<sup>8</sup> A number of categories for these food types were

determined<sup>iv,1</sup> and all foods containing any of these food types (n=3,030) were systematically disaggregated into their components.

The proportion of the composite dish which comprised fruit, vegetable, meat or fish subgroups was determined using a number of sources of information, such as:

- manufactured product information
- standard recipes from McCance and Widdowson's "The Composition of Foods" series<sup>9</sup>
- homemade recipes from participants' food diaries
- haem iron data to estimate meat content when other recipe details were not available
- vitamin A content to estimate tomato puree content in condiments and sauces
- fructose content to calculate proportions of fresh and dried fruit in some food codes
- dishes containing dried vegetables, such as dehydrated soups, were scaled up in relation to water content

Following this initial project new food codes are disaggregated prospectively as they are added to the NDB. Disaggregated data allows the automated estimation of total intakes of fruit, vegetables, meat and fish in the NDNS RP, including the contribution from composite dishes.

#### A.4.3 Calculation of 5 A Day using disaggregated data

One of the estimates required for NDNS reporting is the intake of fruit and vegetables, specifically how participants' intakes compare to the government recommendations to eat 5 A Day.<sup>10</sup> The information on the fruit and vegetable content of each disaggregated food code was used to calculate the number of portions of fruit and vegetables consumed for each participant aged 11 years and over, using a portion weight of 80 grams (150 grams for fruit juice). In line with the 5 A Day criteria<sup>10</sup> fruit juice and smoothies<sup>v,11</sup> combined and pulses (including baked beans) were included in the calculation up to a maximum of 1 portion per day each. The calculations included the fruit and vegetable content of foods such as meat, fish, pasta, rice and egg dishes, pizza, breakfast cereals, yogurts and dairy desserts and soups. Puddings and fruit pies were also included as these can contain significant amounts of fruit. Other foods that fell into the 'high fat/ high sugars' segment of the Eatwell Guide<sup>11</sup> from the 5 A Day calculations were excluded from the calculation on the grounds that healthy eating advice is to reduce consumption of foods in this group, so it would not be appropriate to include their fruit and vegetable content in the 5 A Day estimates. Therefore the fruit and vegetable content of the following food groups<sup>vi,1</sup> was excluded from the estimates:

- soft drinks (57A, B and C, 58A, B, and C)

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<sup>iv</sup> Disaggregation categories are listed in appendix R of the Years 1 to 9 report

<sup>v</sup> The calculation for smoothies changed in Year 9 due to a change in advice in 2016.

<sup>vi</sup> Main and subsidiary NDNS food groups are listed in appendix R of the Years 1 to 9 report



- confectionery (43R and 44R)
- cakes (including fruit cake) and biscuits (7A, 7B, 8D and 8E)
- sugar, preserves (including jam) and sweet spreads (41A, 41B, 41R)
- savoury snacks (42R)
- ice cream (53R)

The calculation of 5 A Day portions was performed as follows:

- daily consumption of fruit juice (from 100% fruit juice) and smoothies<sup>v</sup> was limited to 150g – 1 portion
- daily consumption of baked beans and other pulses was limited to 80g – 1 portion
- daily consumption of dried fruit was multiplied by 3 to account for effects of drying<sup>vii</sup>
- daily consumption of tomato puree was multiplied by 5 to account for effects of concentration<sup>viii</sup>
- total weight of fruit and vegetables (including the weights of baked beans and other pulses, dried fruit and tomato puree, modified as above) was divided by 80 to arrive at the number of fruit and vegetable portions
- fruit juice (from 100% fruit juice) and smoothies were divided by 150 to arrive at the number of portions of fruit juice/smoothies<sup>ix</sup>
- the number of fruit and vegetable portions and the number of portions of fruit juice/smoothies were added to give total 5 A Day portions consumed

5 A Day portions were not calculated for children aged 10 years and younger. The 80g portion weight used in the calculation for adults and children aged 11 years and over is likely to be too large for younger children.

## A.5 Dietary feedback to participants

Participants who completed 3 or 4 diary recording days were asked whether they would like to be sent feedback on the analysis of their diary and how this compared with dietary recommendations. The feedback consisted of the participant's average daily energy intake and graphs of intake for 8 different nutrients (total fat; saturated fat; free sugars; AOAC fibre; vitamin C; folate; calcium; and iron), each of which showed the average daily intake, based on the participant's diet over the diary recording period. The graphs also highlighted the UK guideline intake for the nutrient and the range of observed intakes for the participant's age group from previous NDNS RP results Years 1 to 4 so that participants could compare their intake with other people of the same age and sex. The feedback also included general information on sources of healthy eating advice.

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<sup>vii</sup> Dried fruit is multiplied by 3 to ensure that it is comparable to non-dried fruit on the basis of their respective micronutrient contents.

<sup>viii</sup> Tomato puree is multiplied by 5 to ensure that it is comparable to canned tomatoes on the basis of their respective carotene contents. For example, 10g tomato puree and 50g canned tomatoes would provide approximately the same amount of carotenes (178µg and 181µg respectively).

<sup>ix</sup> The calculation for smoothies changed in Year 9 due to a change in government advice in 2016.

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- <sup>1</sup> National Diet and Nutrition Survey Years 1 to 9 of the Rolling Programme (2008/2009 – 2016/2017): Time trend and income analyses <https://www.gov.uk/government/statistics/ndns-time-trend-and-income-analyses-for-years-1-to-9>.
- <sup>2</sup> Fitt, E., Cole, D., Ziauddeen, N., Pell, D., Stickley, E., Harvey, A. and Stephen, A.M. (2015). DINO (Diet In Nutrients Out) - An integrated dietary assessment system. *Public Health Nutr* 18(2): 234-41).
- <sup>3</sup> Food Standards Agency (2002) Food portion sizes. 3<sup>rd</sup> edition. London: TSO.
- <sup>4</sup> Wrieden WL, Longbottom PJ and Barton KL. Children's food portion sizes: Estimation of portion sizes for children of different ages. Final technical report to the Food Standards Agency. London: Food Standards Agency, 2003.
- <sup>5</sup> Howell Davies O, Suleiman S, Nicholas J, Bradbury J, Msebele S, Prior G, Hall L, Wreford S, Jarvis L, McGee A, Poulter J & Nelson M. (2008) Food portion weights in primary and secondary school lunches in England. *J Hum Nutr Diet* 21 pp.46-62.
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