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National Diet and Nutrition Survey (NDNS RP): Results from Years 1-4 (combined) for Northern Ireland (2008/09-2011/12)

A survey carried out on behalf of the Food Standards Agency in Northern Ireland and Public Health England

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About Food Standards Agency in Northern Ireland

Food Standards Agency in Northern Ireland (FSA in NI) is responsible for devolved matters relating to food safety, standards, nutrition and dietary health in Northern Ireland and has responsibility for monitoring the diet of the population in Northern Ireland.

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Notes to text and tables

- 1 The data used in the report have been weighted. The weighting is described in Appendix B of this report. Unweighted sample sizes are shown at the foot of each table.
- 2 The NDNS RP requires weights to adjust for differences in sample selection and response. The weights adjust for:
 - differential selection probabilities of addresses, households and individuals
 - non-response to the individual questionnaire
 - non-response to the nurse visit
 - non-response of participants aged 16 years and older to the physical activity self-completion questionnaire (the RPAQ)
 - non-response to providing a blood sample
 - non-response to providing a 24-hour urine sample
 - non-response to wearing an ActiGraph
- 3 The data were analysed as follows:
 - chapter 3: with the complex surveys module (SPSS version 18.0)
 - chapter 4: with the complex surveys module (SPSS version 20.0)
 - chapters 5, 6 and 8 and Appendices Q, S and T: with SPSS version 22
 - Chapters 7 and 9: with the complex survey package (R version 3.0.2)
 - Chapter 10: with SPSS version 22 and the complex survey package (R version 3.0.2)
- 4 The following conventions have been used in tables:
 - no observations (zero value)
 - 0 non-zero values of less than 0.5% and thus rounded to zero
 - [] unless stated otherwise data and bases for a variable with a cell size between 30-49 are presented in square brackets. For cell sizes below 30, bases have been presented in square brackets, but data has not been presented. The 2.5th and 97.5th percentiles have only been presented for a variable with a cell size of 50 or greater.
- 5 Because of rounding, row or column percentages may not add exactly to 100%.
- 6 A percentage may be quoted in the text for a single category that aggregates two or more of the percentages shown in a table. The percentage for the single category may, because of rounding, differ by one percentage point from the sum of the percentages in the table.

- 7 Values for means, medians, percentiles and standard deviations and standard errors are shown to an appropriate number of decimal places. For reasons of space, Standard Error may sometimes be abbreviated to SE and Standard Deviation to sd.
- 8 'Missing values' occur for several reasons, including refusal or inability to answer a particular question; refusal to co-operate in an entire section of the survey (such as the nurse visit or a self-completion questionnaire); and cases where the question is not applicable to the participant. In general, missing values have been omitted from all tables and analyses.
- 9 The group to whom each table refers is stated at the upper left corner of the table.
- 10 The term 'significant' refers to statistical significance (at the 95% level) and is not intended to imply substantive importance.
- 11 It should be noted that for some dietary variables the UK values in this Northern Ireland report will not exactly match the values in the UK report due to an update in the coding of diluent water for soft drinks after publication of the UK report. The updated dataset has been used to produce values for this report.

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Executive summary

Erratum note: Correction to the fruit and vegetable consumption and salt intake data

This Executive Summary has been updated in 2017 since first publication (in February 2015) to take account of corrections to fruit and vegetable consumption estimates due to an error in the calculation and to salt intake values due to bias detected in the original analytical data. Further details are provided in chapters 5 and 7.

Introduction

The National Diet and Nutrition Survey Rolling Programme (NDNS RP) is a continuous programme of fieldwork designed to assess the diet, nutrient intake and nutritional status of the general population aged 1.5 years and over living in private households in the UK. The core NDNS RP is jointly funded by Public Health England (PHE)¹ and the UK Food Standards Agency (FSA) and is carried out by a consortium of three organisations: NatCen Social Research (NatCen), MRC Human Nutrition Research (HNR) and the University College London Medical School (UCL).² FSA in Northern Ireland (FSA in NI) has responsibility for monitoring the diet of the population in Northern Ireland and therefore has co-funded additional recruitment for NDNS RP. Recruitment in Northern Ireland was boosted to 200 participants per year for four years (2008/09 to 2011/12), in order to achieve representative dietary health data specific for Northern Ireland. The Northern Ireland boost has been co-funded by three funding partners: the Department of Health, Social Services and Public Safety (DHSSPS); the Food Safety Promotion Board (Safefood)^{3,4} and FSA in NI.

This publication of the Northern Ireland NDNS RP Years 1 to 4 report, forms part of a series of report publications from the NDNS RP, the first of which was the UK combined data report covering Years 1 to 4 (2008/09 to 2011/12), released as an Official Statistic by PHE in May 2014.⁵ This was followed by the Scotland report for the equivalent time period, released as an Official Statistic by FSA in Scotland in September 2014.⁶ It is recognised that Northern Ireland has to catch up with its nutritional surveillance work; the combined results from Years 1 to 4 is the first time that representative data for Northern Ireland from the NDNS RP has been available.

The data will inform dietary surveillance in Northern Ireland; measure against the performance indicators published in the Obesity Prevention Strategy; assist in evaluating existing policies; and set future, evidence-based policy direction.

The NDNS RP provides high quality data on the types and quantities of foods consumed by individuals, from which estimates of average nutrient intakes for the population can be derived.⁷ The main report presents combined results from Years 1 to 4 of the NDNS RP for the Northern Ireland sample, designed to be nationally representative. It follows the same general format as the UK report⁵ including types and quantities of foods consumed, and compares intakes of key foods and nutrients in Northern Ireland with the UK and by household income and deprivation indices. The report also includes findings from blood indices of nutritional status and salt intakes from measurement of 24-hour urinary sodium excretion. It also includes information on Body Mass Index (BMI), blood pressure, blood cholesterol levels and the socio-demographic characteristics of the participants.

The Health Survey for Northern Ireland 2012/13⁸ showed that 62% of adults measured in Northern Ireland are either overweight (37%) or obese (25%). The need for a strong evidence base which provides information on the dietary health and nutritional status of the Northern Ireland population has become particularly acute with the cross-Departmental Obesity Prevention Strategy for Northern Ireland: *A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022*.⁹ The Strategy identifies “marker foods” (fruit and vegetables;¹⁰ sugary, fizzy drinks and squashes;¹¹ confectionery;¹² chips and other fried foods;¹³ and meat products¹⁴). The purpose of the “marker foods” is to monitor those food categories which are of public health interest.

This executive summary provides background information on the survey, including sample and methodology, and presents some of the key findings from the Northern Ireland Years 1 to 4 report on food consumption, nutrient intake and nutritional status.

Headline findings

- Fruit and vegetable consumption in Northern Ireland was significantly lower than in the UK as a whole; 83% of adults, 77% of older adults and 96% of children aged 11 to 18 years in Northern Ireland did not meet the five-a-day recommendation.¹⁵
- Mean intakes of non-starch polysaccharide (NSP) were significantly lower than those in the UK as a whole and for adults were below the recommended level.
- Mean consumption of oil-rich fish was well below the recommended one portion per week and was significantly lower than in the UK as a whole.
- Mean consumption of red and processed meat for men and boys aged 11 to 18 years exceeded the current maximum recommendation for adults.
- Mean intakes of saturated fat exceeded recommendations in all age groups and were similar to or slightly higher than mean intakes in the UK as a whole.
- Mean intakes of non-milk extrinsic sugars (NMES) exceeded recommendations in all age groups except those aged 65 years and over, and were similar to or slightly lower than mean intakes in the UK as a whole.
- Mean salt intakes exceeded the recommended maximum for children aged 11 to 18 years and for both males and females aged 19 to 64 years. Mean intake for adults was similar to that in England.
- For the majority of vitamins and minerals, intakes were similar to or slightly lower than the UK as a whole. As for the UK as a whole, there was evidence of low intakes for some vitamins and minerals, particularly in the 11 to 18 years age group.
- A third of adults aged 19 to 64 years in Northern Ireland had low blood levels of vitamin D, a higher proportion than in the UK as a whole.
- Adults and children in the lowest income / most deprived tertile had lower fruit and vegetable consumption than the highest income / least deprived tertile. They also had lower intakes of NSP and some vitamins and minerals.

Sample and response rates

A random sample of 2,619 addresses from 97 postcode sectors, drawn from the Postcode Address File, was issued in Northern Ireland between April 2008 and March 2012. Where there were multiple households at an address, a single household was selected at random. For each household, either one adult (aged 19 years and over) and one child (aged 1.5 to 18 years), or one child only were randomly selected to take part.¹⁶ Selected individuals were asked to complete a diary of food and drink consumption over four consecutive days (with the start date randomly allocated) and an interview was conducted to collect background information on dietary habits, socio-demographic status, lifestyle and physical activity (stage one). Participants who agreed to a nurse visit (stage two) were asked to provide a blood sample to assess biochemical indices of nutritional status and those who were aged four years and older were asked to provide a 24-hour urine collection to assess salt intake. Physical measurements were also collected.

Response rates achieved in Northern Ireland for Years 1 to 4 combined were as follows:

Individual response	N	%
Completion of food and drink diary (3 or 4 days) ^a	982 (470 adults, 512 children)	64%
<i>Of those completing a food and drink diary:</i>		
Blood sample obtained ^b	365 (264 adults, 101 children)	56% of adults, 20% of children
24-hour urine sample obtained ^b	565 (304 adults, 261 children)	65% of adults, 63% of children

^a The majority of participants completed four days of the food and drink diary. Only 2% completed three days.

^b All individuals visited by a nurse were asked if they were willing to provide a blood sample and, if aged four years and older (and fully out of nappies), a 24-hour urine sample.

The data were weighted to minimise any bias in the observed results which may be due to differences in the probability of households and individuals being selected to take part; and to attempt to reduce non-response bias.¹⁷ Details of the sampling and methods of analyses can be found in Chapter 2 and Appendix B of this report.

Current UK diet and nutrition recommendations

The NDNS RP Northern Ireland findings are compared with the UK recommendations for food and nutrient intakes. Current UK recommendations for consumption of fruit and vegetables, red and processed meat and oily fish are shown below.

Food	Recommendation
Fruit and vegetables	At least 5 portions per day for those aged 11 years and over ¹⁸
Red and processed meat ^a	Should not exceed 70g per day for adults ¹⁹
Oily fish ^b	At least 1 portion per week for all ages (140g) ²⁰

^a Red meat includes beef, lamb, pork, sausages, burgers and kebabs, offal, processed red meat and other red meat.

^b Oily fish includes anchovies, carp, trout, mackerel, herring, jack fish, pilchards, salmon (including canned), sardines, sprats, swordfish, tuna (fresh only) and whitebait

The Dietary Reference Values (DRVs) for key macronutrients are shown below. These indicate the average or the maximum contribution that these nutrients should make to the population average intakes of these nutrients. In addition, biochemical measures of blood lipids are compared with clinical thresholds to provide an indication of the proportion of the population at increased risk of vascular disease.

Macronutrient	Dietary Reference Value²¹
Total fat	Population average no more than 35% of food energy for those aged 5 years and over
Saturated fatty acids	Population average no more than 11% food energy for those aged 5 years and over
<i>Trans</i> fatty acids	Population average no more than 2% food energy
Non-milk extrinsic sugars (NMES)	Population average no more than 11% food energy for all ages
Non-starch polysaccharides (NSP)	Adult population average at least 18g per day

Population adequacy of micronutrient intake is assessed by comparing intake with the age and sex specific UK DRV for each vitamin and mineral.²¹ In addition, biochemical indices of micronutrient status are compared with threshold values, where they have been set, to give an estimate of the proportion of the population at greater risk of deficiency due to depleted body stores or tissue concentrations.

Key findings

Erratum note: correction to fruit and vegetable consumption data

Consumption figures in this section have been corrected for an error in the estimation of fruit, vegetables and fruit juice and the calculation of “5-A-Day” portions. Fruit and vegetable components of some food groups (soft drinks, confectionery, biscuits, cakes, sugar, preserves and sweet spreads, savoury snacks and ice cream) were included in the estimates when they should have been excluded. This has now been corrected and the corrected values are slightly lower than the original published values. Further details are provided in chapter 5.

Food consumption²² and nutrient intakes (Chapter 5)

Table 1.1 provides a summary of the consumption of selected foods for adults and children in Northern Ireland. Seventeen per cent of adults and 23% of older adults met the “5-A-Day” recommendation.^{15,18} Four per cent of boys and girls aged 11 to 18 years met the “5-A-Day” recommendation.¹⁵ Mean consumption of oily fish in all age groups was well below the recommended one portion (140g) per week.²⁰

Mean consumption of red and processed meat for men aged 19 to 64 years and boys aged 11 to 18 years exceeded the current recommendation that, for adults, average intakes should not exceed 70g per day.¹⁹

Table 1.1 Average daily intake of selected foods, for NDNS RP Northern Ireland Years 1-4 combined					
Food	NDNS age group (years)				
	1.5-3	4-10	11-18	19-64	65+
"5-A-Day" portions (portions/day) ^{a,15}	-	-	2.3	3.3	3.6
Fruit g/day ^b	89	89	53	79	110
Vegetables g/day ^c	57	68	83	149	142
Oily fish g/day ^d	1	1	1	4	10
Red and processed meat g/day ^e	39	53	72	82	69
<i>Bases (unweighted)</i>	<i>94</i>	<i>182</i>	<i>236</i>	<i>391</i>	<i>79</i>

^a To calculate "5-A-Day" portions of fruit and vegetables see Chapter 5 and Appendix A. Children under 11 years have not been included as the 80g portion is only appropriate for older children and adults.

^b Average daily consumption (mean in grams) of fruit including contribution from composite dishes, also includes fruit from smoothies.

^c Average daily consumption (mean in grams) of vegetables (not including potatoes) including contribution from composite dishes.

^d Oil rich fish, referred to in the main report as 'oily fish' includes anchovies, carp, trout, mackerel, herring, jack fish, pilchards, salmon (including canned), sardines, sprats, swordfish, tuna (fresh only) and whitebait.

^e Red and processed meat referred to in the main report as 'total red meat' includes beef, lamb, pork, sausages, burgers and kebabs, offal, processed red meat and other red meat.

Table 1.2 provides a summary of the reported total energy intake for adults and children in Northern Ireland. Mean energy intakes were below the Estimated Average Requirement (EAR)²³ for adults and children aged 11 years and over. However it should be borne in mind that the UK doubly labelled water (DLW) sub-study showed evidence of under-reporting of energy intakes in these age groups; see Appendix X of the main report for more details. 'Cereals and cereal products' was the largest contributor to energy intake in all age groups. 'Meat and meat products' and 'milk and milk products' were the other major contributors with 'milk and milk products' making a larger contribution in younger children.

Table 1.2 Average daily total energy intake for NDNS RP Northern Ireland Years 1-4 combined

Total energy	NDNS age groups (years)					
	1.5-3	4-10	11-18	19-64		65+
	Sex-combined	Sex-combined	Sex-combined	Men	Women	Sex-combined
MJ	4.78	6.44	7.40	8.86	6.65	7.21
kcal	1132	1529	1758	2108	1581	1713
<i>Bases (unweighted)</i>	94	182	236	145	246	79

Table 1.3 provides a summary of the intakes of selected macronutrients for adults and children in Northern Ireland.

- Mean intake of total fat met the DRV (no more than 35% food energy) in all age/sex groups except for men aged 19 to 64 years (36.5%). Mean intake of saturated fat exceeded the DRV (no more than 11% food energy) in all age/sex groups, whilst mean intake of trans fatty acids met the DRV (no more than 2% food energy). Milk and milk products, cereals and cereal products' and 'meat and meat products' were the main contributors to intake; milk made a larger contribution for younger children.
- Mean NMES intake exceeded the DRV (no more than 11% food energy) for all age/sex groups except those aged 65 years and over. For children, the main source of NMES was 'non-alcoholic beverages' (soft drinks and 'fruit juice' – soft drinks provided 32% of NMES intake in the 11 to 18 years age group with a further 8% from fruit juice). 'Cereals and cereal products' (mainly cakes, biscuits and breakfast cereals) and 'sugar, preserves and confectionery' (mainly confectionery) were the other major contributors in children. For adults aged 19 to 64 years, 'sugar, preserves and confectionery' (including table sugar), 'non-alcoholic beverages' (soft drinks and 'fruit juice') and 'cereals and cereal products' (mainly cakes and 'biscuits') made similar contributions to intake. For older adults, 'cereals and cereal products' was the largest contributor, mainly from cakes and 'biscuits'. 'Sugar, preserves and confectionery' was also a major contributor in this age group (mainly from table sugar).

- Mean intake of non-starch polysaccharide (NSP) for adults aged 19 to 64 years and 65 years and over was below the DRV set for adults of at least 18g per day. 'Cereals and cereal products' and 'vegetables and potatoes' were the main sources of NSP.

Table 1.3 Average daily intake of selected macronutrients, for NDNS RP Northern Ireland Years 1-4 combined					
Macronutrient	NDNS age group (years)				
	1.5-3	4-10	11-18	19-64	65+
Total fat % food energy	34.3	33.9	34.1	35.6	34.7
Saturated fatty acids % food energy	14.8	13.6	12.5	13.1	13.9
<i>Trans</i> fatty acids % food energy ^a	0.6	0.6	0.6	0.7	0.8
NMES % food energy	12.2	14.6	14.3	12.1	10.5
NSP g	7.8	9.9	11.3	12.9	13.3
<i>Bases (unweighted)</i>	94	182	236	391	79

^a Due to rounding some values appear the same in the tables, however, the values are different once they are presented to further decimal places (see Chapter 10, Table 10.1c).

Fifty per cent of men and 41% of women aged 19 to 64 years reported consuming alcohol over the four-day diary period. On average, men in this age group who consumed alcohol during the four-day diary period obtained 10.7% of energy intake from alcohol while women in this age group obtained 6.9%.

Table 1.4 provides a summary of the intakes of selected micronutrients for adults and children in Northern Ireland. Mean intake is compared with the Reference Nutrient Intake (RNI)²⁴ and an estimate is made of the proportion with intake below the Lower Reference Nutrient Intake (LRNI).²⁵

- Mean daily intakes of most vitamins from food sources were close to or above the RNI for all age and sex groups. For girls aged 11 to 18 years, 19%, 21% and 7% had intakes below the LRNI for vitamin A, riboflavin and folate respectively. Twelve per cent of women aged 19 to 64 years had intakes of riboflavin from food sources below the LRNI.

- For vitamin D, RNIs are set only for those aged up to four years and those aged 65 years and over and there are no LRNIs. Mean intakes from food sources were well below the RNI in both these age groups: 25% for children aged 1.5 to 3 years and 36% for adults aged 65 years and over.²⁶
- Mean intakes of most minerals from food sources were below the RNI for some age/sex groups, in particular children aged 11 to 18 years. Substantial proportions of this age group, especially girls, had intakes of minerals (for example iron, magnesium and potassium) below the LRNI. Mean intakes of all minerals were close to or above the RNI for children aged under 11 years and few children in this age group had intakes below the LRNI.
- Twenty-four per cent of adults aged 19 to 64 years (17% of men, 31% of women) and 40% of adults aged 65 years and over reported taking at least one dietary supplement during the four-day diary recording period.

Table 1.4 Average daily intake as a percentage of the Reference Nutrient Intake (RNI) from food sources only and proportion of participants with average daily intakes below the Lower Reference Nutrient Intake (LRNI) for selected micronutrients, for NDNS RP Northern Ireland Years 1-4

Micronutrients ^a	NDNS RP survey years and age groups (years)							
	Boys		Total	Men	Girls		Total	Women
	4-10	11-18	boys	19-64	4-10	11-18	girls	19-64
Vitamin A								
Mean % RNI	129	104	115	136	113	86	98	133
% with intake below the LRNI	2	8	5	11	9	19	15	6
Riboflavin								
Mean % RNI	181	140	158	134	157	115	134	122
% with intake below the LRNI	1	8	5	4	2	21	13	12
Folate								
Mean % RNI	156	115	133	132	141	91	113	105
% with intake below the LRNI	1	2	1	3	0	7	4	5
Iron								
Mean % RNI	115	93	103	127	103	56	77	73
% with intake below the LRNI	1	7	4	3	6	50	31	27
Calcium								
Mean % RNI	167	93	126	122	155	85	116	102
% with intake below the LRNI	1	7	4	5	2	16	10	9
Magnesium								
Mean % RNI	120	77	96	89	116	62	86	78
% with intake below the LRNI	2	26	15	23	5	63	37	14
Potassium								
Mean % RNI	148	77	109	83	143	63	99	69
% with intake below the LRNI	0	12	7	13	2	36	21	24
Selenium								
Mean % RNI	126	77	99	62	121	65	90	65
% with intake below the LRNI	1	27	15	40	3	52	30	60
Zinc								
Mean % RNI	95	90	92	98	90	82	86	103
% with intake below the LRNI	8	10	9	5	8	23	16	6
Bases (unweighted)	94	120	214	145	88	116	204	246

^aThe % of RNI for vitamin D has not been included in this table, as RNI's for vitamin D have only been set for those aged 1.5-3 years and 65 years and over.

Detailed age breakdown for young people and adults (Chapter 8)

Results for key foods and nutrients are presented for Northern Ireland for four age groups, subdivided by sex: 11 to 15 years, 16 to 24 years, 25 to 49 years and 50 to 64 years. These age groups differ from the age/sex groups used elsewhere in the report and are referred to as “age sub-groups”.

- Mean daily intake of saturated fat as a percentage of food energy exceeded the DRV for all age sub-groups.
- Mean intake of NMES as a percentage of food energy exceeded the DRV in all age sub-groups, except males and females aged 50 to 64 years.
- Females aged 11 to 15 years had mean intakes below the RNI²⁴ for iron and calcium (59% and 86% respectively). Females aged 16 to 24 years had mean intakes below the RNI²⁴ for iron, calcium and folate (55%, 89% and 84% respectively), and females aged 25 to 49 years had mean intakes below the RNI²⁴ for iron only (61% of the RNI).
- For females, 44%, 51% and 36% of those aged 11 to 15 years, 16 to 24 years and 25 to 49 years respectively had iron intakes below the LRNI. For females, 16%, 12%, 9% and 9% of those aged 11 to 15 years, 16 to 24 years, 25 to 49 years and 50 to 64 years had calcium intakes below the LRNI and 14% of females aged 16 to 24 years had intakes below the LRNI²⁵ for folate.
- The number of portions of fruit and vegetables consumed per day and the proportion of participants meeting the “5-A-Day” recommendation¹⁸ increased with age but overall was lower for all age/sex sub-groups in Northern Ireland compared with the UK.
- Overall, mean consumption of Northern Ireland “marker foods”, other than fruit and vegetables, (sugar, fizzy drinks and squashes;¹¹ confectionery;¹² chips and other fried foods;¹³ and meat products¹⁴) tended to be higher in Northern Ireland compared to the UK.

Intake by equivalised income or by Northern Ireland Multiple Deprivation Measure (Chapter 9)

Households were grouped into tertiles, ranked by equivalised income²⁷ and separately by Northern Ireland Multiple Deprivation Measure (NIMDM).²⁸ Statistical comparisons were undertaken for intakes of key foods and nutrients by tertiles of equivalised income or NIMDM within each sex-combined age group. Tertile 3 (the highest income or lowest deprivation) was used as the reference category.

- There were some differences observed in food consumption, energy and nutrient intakes by equivalised household income and NIMDM tertiles, particularly for fruit and vegetable consumption. Differences were clearest between the lowest and highest tertiles but were not seen in all age groups.
- Overall, there were no clear differences by equivalised household income or NIMDM for energy intake or macronutrients. The exception was NSP intake which was lower in the lowest income/most deprived tertiles in all age groups.
- Mean intake of micronutrients tended to be lower in the lower equivalised income tertiles and the most deprived NIMDM tertiles compared with the least deprived tertiles. The differences reached statistical significance in some age groups for iron, vitamin C, vitamin D and folate.
- Mean fruit and vegetable consumption expressed in grams and as “5-A-Day” portions¹⁸ was lower in the lowest income/most deprived tertiles than the highest income/least deprived tertiles when split by equivalised income and by NIMDM, with some age groups showing a pattern of increasing intake from the lowest income/most deprived tertile to the highest income/least deprived tertile. However, mean consumption in all tertiles was below the recommendation of “5-A-Day”.¹⁸
- No consistent pattern for total meat, red meat, total fish or oily fish consumption was observed across the age groups.

- With the exception of confectionery,¹² consumption of the Northern Ireland 'marker foods' (sugary, fizzy drinks and squashes,¹¹ chips and fried foods¹³ and meat products¹⁴) tended to be higher in the lower income/most deprived tertiles.

Comparisons between Northern Ireland and the UK for intakes of key foods and nutrients (Chapter 10)

Statistical comparisons were undertaken for intakes of key foods and nutrients between the Northern Ireland sample and the whole of the UK sample of the NDNS RP Years 1 to 4 combined.²⁹ Results are presented by standard age groups; 1.5 to 3 years, 4 to 10 years, 11 to 18 years, 19 to 64 years and 65 years and over and are also subdivided by sex (except for children aged 1.5 to 3 years and adults aged 65 years and over, where numbers are insufficient to subdivide by sex).

- In two age groups (men aged 19 to 64 years and girls aged 4 to 10 years) mean intake of total fat as a % of food energy was significantly higher in Northern Ireland compared with the UK. Mean saturated fat intake as a % of food energy was also higher in adults aged 19 to 64 years in Northern Ireland (13.1%) compared with the UK (12.6%).
- There was no consistent pattern of differences in NMES intakes between Northern Ireland and the UK across the age groups.
- Mean intake of NSP was lower in all age/sex groups in Northern Ireland compared with the UK. Mean intakes were statistically significantly lower for boys and girls aged 4 to 10 years and men aged 19 to 64 years in Northern Ireland compared with the UK.
- Mean iron intake was below the RNI in females aged 11 to 18 and 19 to 64 years in both Northern Ireland and the UK. In girls aged 4 to 10 years and women aged 19 to 64 years mean iron intake was significantly lower in Northern Ireland compared with the UK.
- Mean intake of folate was significantly lower in girls aged 4 to 18 years and in men and women aged 19 to 64 years in Northern Ireland compared with the UK.

- Mean consumption of fruit and vegetables was lower in all age/sex groups in Northern Ireland compared with the UK. All age groups in Northern Ireland where the “5-A-Day” criteria can be applied had a statistically significantly lower mean consumption of portions of fruit and vegetables compared to the UK.
- Mean red meat consumption was higher in Northern Ireland compared with the UK in all age/sex groups whereas mean oily fish consumption was lower in all age/sex groups in Northern Ireland compared with the UK.
- For comparisons between the Northern Ireland sample of the NDNS RP and the Irish National Adult Nutrition Survey (NANS)^{30,31} mean energy intake, dietary fibre, iron, calcium, vitamin C and folate intake was higher in NANS compared with the NDNS RP. A similar picture was also observed for mean fruit and vegetable consumption. However, the methodological differences of the surveys should be kept in mind when comparing these two different surveys.

24-hour urine analyses: Sodium excretion and estimated Salt intake³²

Erratum note: The results in this section were excluded from the original report published in February 2015. The results published here have been corrected to take account of analytical bias in sodium concentrations and are in line with data republished in the UK year 1-4 report in February 2017 and the urinary sodium surveys of adults in England and Scotland (2014)^{33,34} and Northern Ireland (2015).³⁵

Salt intake has been estimated from urinary sodium excretion. Table 1.5 presents the recommended maximum salt intake per day for adults, which was set by COMA³⁶ and endorsed by the Scientific Advisory Committee on Nutrition (SACN) in its report on Salt and Health (2003) and the recommended maximum intakes set by SACN (2003) for children.³⁷

In Northern Ireland, for those aged 11 to 18 years and adults aged 19 to 64 years, mean estimated salt intake was higher than the maximum recommended intake.

Mean estimated salt intake was 6.7g/day for children aged 11 to 18 years and 8.6g/day for adults aged 19 to 64 years; 9.7g/day for men aged 19 to 64 years and 7.5g/day for women aged 19 to 64 years. The mean estimated salt intake for children aged 11 to 18 years was 12% greater than the SACN recommendation of a population average of no more than 6g/day, whilst the mean estimated salt intake for adults aged 19 to 64 years was 43% greater than the SACN recommendation.

Since this report was originally published new data have been published for salt intakes for adults in England (2014)³³ and Northern Ireland (2015).³⁵ This report has not been updated to reflect these new results.

Table 1.5 Average estimated salt intake (g/day), for NDNS RP Northern Ireland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, by age^a

NDNS age/sex group ^b	Recommended maximum salt intake (g/day) ^{36,37,c,d}	Northern Ireland Years 1-4 combined ^e (g/day)	Northern Ireland Years 1-4 combined ^e % difference of sample mean from population recommendation	UK Years 1-4 combined ^{e,f} and England 2011 survey ^{e,g} (g/day)	UK Years 1-4 combined ^{e,f} and England 2011 survey ^{e,g} % difference of sample mean from population recommendation
11 to 18 years	6	6.7 (n=60)	12 (n=60)	7.0 ^f (n=377)	16 ^f (n=377)
19 to 64 years	6	8.6 (n=170)	43 (n=170)	8.5 ^g (n=547)	49 ^g (n=547)
19 to 64 years males	6	9.7 (n=67)	61 (n=67)	9.8 ^g (n=250)	63 ^g (n=250)
19 to 64 years females	6	7.5 (n=103)	26 (n=103)	7.2 ^g (n=297)	20 ^g (n=297)

^a complete by standard criteria only.

^b Results are not presented for children aged 4 to 6 years as base numbers are below 50.

^c 1g salt contains 17.1mmol sodium.

^d These are the maximum daily dietary targets.

^e Counts are provided in brackets.

^f The UK report for years 1 to 4 of the NDNS RP⁵ reported urinary sodium results from participants aged 4 to 18 years and 65 years and over only.

^g The most recent published data for adults in England comes from a 24-hour urinary sodium survey carried out in 2011.³⁸

Biochemical indices of nutritional status (Chapter 6)

This section reports on the Northern Ireland results of blood samples taken from participants during the NDNS RP, which provide an assessment of the availability of nutrients to the body (after absorption) for use in metabolic processes.

- There was evidence of low vitamin D status in all age/sex groups in Northern Ireland. For children aged 11 to 18 years; 29.5% had a 25-OHD concentration below 25nmol/L (the current threshold indicating vitamin D adequacy) at the time of venepuncture. For adults, 34.3% of those aged 19 to 64 years and 18.7% of those aged 65 years and over had a 25-OHD concentration below 25nmol/L at the time of venepuncture. For adults aged 19 to 64 years and children aged 11 to 18 years the proportion with low vitamin D status was higher in Northern Ireland than in the UK as a whole. Low vitamin D status has implications for bone health, including increasing the risk of rickets and osteomalacia.
- There was evidence of iron-deficiency anaemia (as indicated by low haemoglobin concentrations) and low iron stores (plasma ferritin) in 4.2% of adult women in Northern Ireland, a similar proportion to UK as a whole.
- A substantial proportion of participants aged four years and over had riboflavin status values, based on raised EGRAC, indicating biochemical depletion. However, there is uncertainty about the functional consequences of a raised EGRAC. Therefore, in addition to using this threshold, changes in the riboflavin status of the UK population will also be monitored by reviewing the EGRAC values at the 75th and 90th percentiles in successive years (see Table 6.2).

- There is little evidence of low status for other micronutrients where normal ranges or thresholds for low status have been set. Mean values for vitamin C, B₁₂, thiamin as indicated by ETKAC, retinol and vitamin E fell within the normal range.
- In adults aged 19 to 64 years and 65 years and over, 35.4% and 16.9% respectively had a serum total cholesterol between 5.2 and 6.4mmol/L, indicating a marginally increased risk of cardiovascular disease. The proportion of adults aged 19 years and over with a serum total cholesterol between 6.5 and 7.8mmol/L indicating moderately elevated cardiovascular risk was 7.6% for those aged 19 to 64 years and 22.9% for those aged 65 years and over, with a further 1.0% of those aged 19 to 64 years having a serum total cholesterol greater than 7.8mmol/L, indicating severe risk.

Methodological issues

An overview of the purpose, documents, methodologies, procedures for data collection and quality control are provided in the main report along with supporting technical appendices. These include a consideration of the methodological issues and limitations which include self reported measures of food intake, time between diet and nutritional status assessment and days of the week in the food diary. This should be borne in mind while interpreting these findings (see Chapter 5 and Appendix X of the main report for more detail).

Future reports

A urinary sodium survey of adults aged 19 to 64 years in Northern Ireland³⁵ in 2015 and urinary sodium surveys of adults aged 19 to 64 years in Scotland³⁴ and in England³³ in 2014 as part of the NDNS RP were published in 2016. A direct comparison of estimated salt intakes between Northern Ireland and England are available in the 2015 Northern Ireland sodium survey report published in 2016.³⁵

The UK, Scotland, Northern Ireland and Wales results for blood folate status were originally published in March 2015, but the thresholds published by the WHO which were used in that report were set using blood folate data based on different laboratory assays from those used to analyse NDNS samples. Measurements of blood folate are specific to the assay method and the laboratory used; therefore thresholds need to be appropriate to the assay method or to have been adjusted for the assay method used.

Consequently, the report on folate status in the UK, Scotland and Northern Ireland as determined in Years 1 to 4 and in Wales in Years 2 to 5 of the NDNS RP will be republished in 2017.

A further round of additional recruitment in Northern Ireland is taking place over four years from 2013/14 to 2016/17. This will allow an analysis of changes in the Northern Ireland diet and nutrition over time.

¹ Responsibility for nutrition policy in England and Wales transferred from FSA to Health Departments in 2010. Management of NDNS also transferred to the Department of Health in England at that time. From 1 April 2013, responsibility for the survey transferred to the Department of Health's Executive Agency, Public Health England (PHE).

² For Year 6 onwards, the consortium comprises NatCen and HNR.

³ FSA in NI, DHSSPS and SafeFood have funded boosts in Years 1 to 4 and Years 6 to 9.

⁴ Increased sample sizes were similarly funded in Scotland and Wales by government bodies in those countries. Results for Scotland have been published: (<http://www.food.gov.uk/scotland/researchscot/scotlandresearch/ScotlandProjectList/n10036>) and a separate report containing results for Wales will be published in 2015.

⁵ National Diet and Nutrition Survey: results from Years 1 to 4 (combined) of the rolling programme for 2008 and 2009 to 2011 and 2012 <https://www.gov.uk/government/publications/national-diet-and-nutrition-survey-results-from-years-1-to-4-combined-of-the-rolling-programme-for-2008-and-2009-to-2011-and-2012> (accessed 15/09/14).

⁶ National Diet and Nutrition Survey Rolling Programme (NDNS RP): results from Years 1- 4 (combined) for Scotland (2008/09-2011/12) <http://www.food.gov.uk/sites/default/files/ndns-scotland-full-report.pdf> (accessed 15/10/14).

⁷ Ashwell M, Barlow S, Gibson S, Harris C (2006) National Diet and Nutrition Surveys: the British experience. Public Health Nutrition 9(4) 523-530.

⁸ http://www.northernireland.gov.uk/news-dhssps-200314-health-survey-northern?WT.mc_id=rss-news (accessed 11/12/14).

⁹ <http://www.northernireland.gov.uk/index/media-centre/news-departments/news-dhssps-march-2013-archive/news-dhssps-november-2010-archive/news-dhssps-151110-fitter-futures-key.htm> (accessed 23/09/14).

¹⁰ Total fruit and vegetables – Total disaggregated fruit and vegetables (excluding fruit juice). A full definition is provided in Appendix R of the main report.

¹¹ Sugary, fizzy drinks and squashes – All types including squashes and cordials, carbonates. Not 100% fruit juice. Not mineral water (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R). A full definition is provided in Appendix R of the main report.

¹² Confectionery – NDNS food groups 43 (sugar confectionery) and 44 (chocolate confectionery). A full definition is provided in Appendix R of the main report.

¹³ Chips and other fried foods – NDNS food groups 38A (chips purchased retail or takeaway. Includes oven and microwave chips), 38C (other purchased potato products fried or baked) and 38D (homemade chips/fried and roast potatoes). A full definition is provided in Appendix R of the main report.

¹⁴ Meat products (including sausages, burgers, meat/chicken pies) – NDNS food groups 29 (burgers - not chicken burgers), 30 (sausages), 31 (meat pies - including chicken pies) and 26A (manufactured coated chicken products). A full definition is provided in Appendix R of the main report.

¹⁵ In the first publication of this report (in February 2015), “5-A-Day” portions were incorrectly calculated. Fruit and vegetable components of food groups that should have been excluded (see Appendix A of this report) were mistakenly included. These were: soft drinks, confectionery, biscuits, cakes, sugar, preserves (including jam) and sweet spreads, savoury snacks and ice cream. The results presented in this chapter have been updated to correctly exclude all of the food groups that should be excluded as part of the “5-A-Day” calculations. Therefore the values for Years 1 to 4 (combined) will be lower than those presented in the first publication of this report in February 2015.

¹⁶ In some core sample households (where up to one adult and one child could be selected), it was possible to end up with an adult participant only, either because the selected child was not able/did not wish to take part or because there was no resident child eligible for selection.

¹⁷ Non-response bias occurs if those who respond to the survey (or elements of the survey) differ from those who do not respond. Data were weighted to reduce such bias.

¹⁸ Department of Health 5 A DAY programme [online]
<http://www.nhs.uk/Livewell/5ADAY/Pages/5ADAYhome.aspx> (accessed 22/10/14).

¹⁹ Scientific Advisory Committee on Nutrition. Iron and Health. London: TSO, 2010. This recommendation applies to adults only. The recommendation is that adults with relatively high intakes of red and processed meat (of 90g or more per day) should consider reducing their intakes.

²⁰ Scientific Advisory Committee on Nutrition. Advice on fish consumption: benefits and risks. London: TSO, 2004.

²¹ Report on Health and Social Subjects 41 *Dietary Reference Values (DRVs) for Food Energy and Nutrients for the UK*, Report of the Panel on DRVs of the Committee on Medical Aspects of Food Policy (COMA) 1991. The Stationery Office. London.

²² Results for food consumption include vegetables, fruit, meat and fish after disaggregation (i.e. including the contribution from composite dishes, both homemade dishes and manufactured products, containing these ingredients but excluding other components of these dishes).

²³ Scientific Advisory Committee on Nutrition. Dietary Recommendations for Energy:[Online]. Available http://www.sacn.gov.uk/pdfs/sacn_dietary_reference_values_for_energy.pdf (2011) (accessed 03/03/14).

²⁴ The RNI for a vitamin or mineral is the amount of the nutrient that is sufficient for about 97% of people in the group. If the average intake of the group is at the RNI, then the risk of deficiency in the group is judged to be very small. However, if the average intake is lower than the RNI then it is possible that some of the group will have an intake below their requirement.

²⁵ The adequacy of vitamin or mineral intake can be expressed as the proportion of individuals with intakes below the LRNI. The LRNI for a vitamin or mineral is set at the level of intake considered likely to be sufficient to meet the needs of only 2.5% of the population.

²⁶ For vitamin D, RNIs are only set for those aged up to four years and those aged 65 years and over.

²⁷ Equivalisation is a standard methodology that adjusts household income to account for different demands on resources, by considering the household size and composition.

²⁸ The Northern Ireland Multiple Deprivation Measure (NIMDM) 2010 comprises seven domains of deprivation, each developed to measure a distinct form or type of deprivation; income, employment, health, education, proximity to services, living environment and crime. Although the term deprivation is often synonymous with monetary poverty it is important to note that only the Income Deprivation Domain is intended to measure poverty in this sense. The remaining six domains focus on other types of deprivation, such as the lack of adequate education or poor health. The domains can be interpreted individually or combined to assess deprivation in more than one domain. http://www.nisra.gov.uk/deprivation/archive/Updateof2005Measures/NIMDM_2010_Report.pdf.

²⁹ The Northern Ireland sample includes core and boost participants. The UK sample also includes the core and boost participants from Northern Ireland. In the UK data, the Northern Ireland cases were weighted down to represent the proportion of participants that the Northern Ireland core participants represent in the UK NDNS RP survey population.

³⁰ The Irish National Adult Nutrition Survey, (2011) was carried out by the Irish Universities Nutrition Alliance. This survey investigated habitual food and beverage consumption, lifestyle, health indicators and attitudes to food and health in a representative sample (n=1500) of adults aged 18 years and over in the Republic of Ireland during 2008-2010. A sample of 1500 adults (men 740, women 760) aged between 18 and 90 years from across the Republic of Ireland took part in the National Adult Nutrition Survey (NANS). Individuals were selected for participation from the Data Ireland (An Post) database of free-living adults in Ireland. Each individual who was selected was contacted by mail and followed up shortly afterwards with a visit from a researcher. Eligible persons (adults aged 18 years and over, excluding women who were pregnant or breast-feeding) were invited to participate and a consent form was signed.

³¹ In Chapter 10 of the main report headline comparisons have been made with the Northern Ireland sample of the NDNS RP and the most recent Irish National Adult Nutrition Survey (NANS) (2011) and observed differences only are reported.

³² Dietary salt intake can only be accurately assessed by measuring sodium excretion in urine. The predominant source of sodium in the diet is “common salt” (sodium chloride). It is not possible to obtain accurate estimates of dietary intake of sodium from food intake information, mainly because of the difficulty with accurately assessing the amount of salt added to food in cooking or at the table. Estimates of sodium intake can be obtained by measuring urinary sodium excretion, assuming the body is in balance for sodium.

³³ National Diet and Nutrition Survey (NDNS): Assessment of dietary sodium for adults (19 to 64 years) in England, 2014 report; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/509399/Sodium_study_2014_England_Text_final.pdf Published 2016 (accessed 27/06/16).

³⁴ National Diet and Nutrition Survey (NDNS): Assessment of dietary sodium for adults (19 to 64 years) in Scotland, 2014 report; http://www.foodstandards.gov.scot/sites/default/files/Monitoring%20the%20Scottish%20Diet-%20Sodium%20Survey%202014%20SCOTLAND_FINAL%20PDF.pdf Published 2016 (accessed 27/06/16).

³⁵ National Diet and Nutrition Survey: Assessment of dietary sodium - Adults (19 to 64 years) in Northern Ireland 2015; <https://www.food.gov.uk/northern-ireland/nutrition/national-diet-and-nutrition-survey-assessment-of-dietary-sodium>. Published 2016 (accessed 06/10/16).

³⁶ Department of Health. Report on Health and Social Subjects: 46. Nutritional Aspects of Cardiovascular disease. HMSO (London, 1994).

³⁷ Scientific Advisory Committee on Nutrition (2003). Salt and Health. The Stationery Office. http://www.sacn.gov.uk/pdfs/sacn_salt_final.pdf (accessed 15/09/14).

³⁸ National Diet and Nutrition Survey - Assessment of dietary sodium in adults (aged 19 to 64 years) in England, 2011 report. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/127916/Sodium-Survey-England-2011_Text_to-DH_FINAL1.pdf (accessed 15/09/14).

1 Background and purpose

Beverley Bates

1.1 Introduction

The National Diet and Nutrition Survey (NDNS) is a survey of the food consumption, nutrient intakes and nutritional status of people aged 1.5 years and older living in private households. The survey is carried out in all four countries of the United Kingdom (UK) and is designed to be representative of the UK population.

The first four years of the NDNS Rolling programme (RP) (2008/09 to 2011/12) were commissioned by the UK Food Standards Agency (FSA) in 2006 and the core survey is now jointly funded by Public Health England and FSA, with additional recruitment boosts funded by Government bodies in Northern Ireland, Scotland and Wales.¹ Details on the background to the NDNS RP can be found in the main UK report of the first four years of the NDNS RP (2008/09 to 2011/12).²

FSA in Northern Ireland (FSA in NI) has responsibility for monitoring the diet of the population in Northern Ireland and has co-funded additional recruitment in 2008/09 to 2011/12 in order to achieve representative data for Northern Ireland and enable comparisons to be made with UK results. The Northern Ireland boost is co-funded by three funding partners: the Department of Health, Social Services and Public Safety (DHSSPS); the Food Safety Promotion Board (Safefood) and FSA in NI.³

The four survey years have been combined to provide a large enough sample on which to base analyses (also see section 1.3). The report provides information about the diet and nutrient intakes of participants in Northern Ireland and includes results from analysis of blood and urine samples.

The NDNS RP is carried out by a consortium of three organisations: NatCen Social Research (NatCen), Medical Research Council Human Nutrition Research (MRC HNR), based in Cambridge and the Department of Epidemiology and Public Health at the Royal Free and University College London Medical School (UCL).⁴ Fieldwork in Northern Ireland is carried out by the Northern Ireland Statistics and Research Agency (NISRA). Haematological and biochemical analyses of blood samples are carried out at MRC HNR and Addenbrooke's Hospital NHS Trust, Cambridge.

1.2 Contents of this report

This report provides information about the diet and nutrient intakes of participants in Northern Ireland from the first four years of the RP (2008/09 to 2011/12).⁵ The report also includes results from analysis of blood and urine samples as well as comparisons between participants in Northern Ireland and the UK.

This first chapter provides an introduction to the NDNS RP. This is followed by information about the research designs, methodologies and response (chapter 2), socio-demographic characteristics of the sample (chapter 3) and physical measurements and physical activity (chapter 4). Chapter 5 focuses on food consumption and nutrient intakes of participants and differences by age and sex and includes comparisons of intakes with government recommendations (Dietary Reference Values).⁶ Chapter 6 provides results from analysis of blood samples for biochemical indices of nutritional status and chapter 7 provides results for sodium intake from 24-hour urine analyses. Chapters 8 to 10 present additional analyses for selected foods and nutrients. Chapter 8 presents a more detailed age breakdown for intakes of key foods and nutrients. Chapter 9 presents a statistical comparison of intakes by equivalised household income and by the Northern Ireland Multiple Deprivation Measure (NIMDM). Chapter 10 presents a statistical comparison of Northern Ireland and UK intakes from the first four years of the RP.

1.3 Aims of the NDNS RP in Northern Ireland

The Health Survey for Northern Ireland 2012/13⁷ showed that 62% of adults measured in Northern Ireland are either overweight (37%) or obese (25%). The need for a strong evidence base which provides information on the dietary health and nutritional status of the Northern Ireland population has become particularly acute with the cross-Departmental Obesity Prevention Strategy for Northern Ireland: *A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022*.⁸ The Strategy identifies “marker foods” (fruit and vegetables; sugary, fizzy drinks and squashes; confectionery; chips and other fried foods; and meat products). The purpose of the “marker foods” is to monitor those food categories which are of public health interest.

It is recognised that Northern Ireland has to catch up with its nutritional surveillance work, particularly longitudinal data and Northern Ireland-specific data (disaggregated from the UK data). The NDNS RP Northern Ireland sample from the UK core sample is insufficient to permit statistically significant analyses; therefore the Northern Ireland sample has been boosted in order to provide statistical robustness for comparison of subsections of the Northern Ireland population. This boost has enabled detailed dietary health data to have been collected from 200 participants per year for the first four years of the RP. These data will inform dietary surveillance in Northern Ireland; allow for cross-country UK comparisons; measure against the performance indicators published in the Obesity Prevention Strategy; assist in evaluating existing policies; and set future, evidence-based policy direction.

The specific aims of the NDNS RP in Northern Ireland are to:

- provide quantitative data on the food and nutrient intakes, sources of nutrients and nutritional status of the population aged 1.5 years and above;
- provide height, weight and other physical measurements;
- provide information on food consumption, nutrient intake and nutritional status in different age groups;
- establish the extent to which the diet of the population meets Government recommendations;

- provide information on intakes of key foods and nutrients and nutritional status measures in different income and deprivation groups; and
- compare the intakes of key foods and nutrients and nutritional status measures in Northern Ireland with the UK population.

¹ Boosted samples in Scotland and Northern Ireland were included from Year 1. A boosted sample in Wales was included from Year 2 (starting April 2009).

² <https://www.gov.uk/government/publications/national-diet-and-nutrition-survey-results-from-years-1-to-4-combined-of-the-rolling-programme-for-2008-and-2009-to-2011-and-2012> (accessed 23/09/14).

³ These three organisations have funded boosted recruitment in Years 1 to 4 and are now funding a further round of boosts in Years 6 to 9 (2013/14 to 2016/17).

⁴ For Years 6 onwards, the consortium comprises NatCen and MRC HNR.

⁵ Fieldwork was carried out between February 2008 and August 2012. Fieldwork for Year 1 began in April 2008 and was completed in June 2009. It was preceded by a short Run In period from February to March 2008 to test procedures. Data from the Run In are included in the results. Fieldwork for Year 2 ran from April 2009 to August 2010. Fieldwork for Year 3 ran from April 2010 to August 2011. Fieldwork for Year 4 ran from April 2011 to August 2012. The fieldwork period was extended from Year 2 onwards to allow for a longer gap between the interviewer and nurse visits.

⁶ Department of Health (1991). Dietary Reference Values for food Energy and Nutrients in the United Kingdom. (Report on Health and Social Subjects, No. 41). London: HMSO

⁷ http://www.northernireland.gov.uk/news-dhssps-200314-health-survey-northern?WT.mc_id=rss-news (accessed 11/12/14).

⁸ <http://www.northernireland.gov.uk/index/media-centre/news-departments/news-dhssps-march-2013-archive/news-dhssps-november-2010-archive/news-dhssps-151110-fitter-futures-key.htm> (accessed 23/09/14).

2 Methodology and response

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2.1 Overview of methodology

This chapter provides an overview of the NDNS Rolling Programme (RP) methodology used in Northern Ireland and the rest of the UK. Although there were few changes to methodology between Years 1 to 4, the key changes are provided in section 2.7.

A sample of people representative of the UK population aged 1.5 years and over was selected. In addition, a “boost” sample was selected in Northern Ireland to increase the numbers in this country, thereby allowing comparisons to be made between Northern Ireland and the UK as a whole.¹ The samples were drawn from the Postcode Address File (PAF),² a list of all the addresses in the UK. In order to improve cost effectiveness the addresses were clustered into Primary Sampling Units (PSUs), small geographical areas, based on postcode sectors, randomly selected from across the UK. A list of addresses was randomly selected from each PSU.

Information describing the purpose of the survey was posted to all selected addresses. This was followed by a face-to-face visit by an interviewer to each address to recruit participants in the eligible age range(s). In order to achieve (as far as possible) equal numbers of adults and children in the sample, at some addresses only children were selected to take part (see section 2.2.2).

At each address, the interviewer enumerated the number of households and, in cases where there were two or more, randomly selected one for the NDNS RP. From each selected household an interviewer randomly selected up to one adult and one child to take part in the survey. These are known as *participants*.

The first stage of the survey comprised a face-to-face Computer Assisted Personal Interview (CAPI) with each participant (or in the case of a young child, their parent or guardian³), completion of a four-day food diary by the participant (outside the interviewer visits) and measurements of height and weight. The interviewer also collected information on shopping and food preparation practices and facilities in the household by additionally interviewing the *Main Food Provider* (MFP)⁴ of the household where this was not a selected participant. The MFP was the person who was best placed to answer questions about food purchased and prepared for the participant(s). The interview also identified the *Household Reference Person* (HRP)⁵ in each household and asked questions about housing tenure, as well as his or her employment, to determine the socio-economic classification of the household.⁶

Participants who took part in the CAPI interview and completed a food diary for at least three days were classified as '*fully productive*' and were invited to take part in the second stage of the survey. This involved a visit from a nurse to take further physical measurements including a blood sample and a 24-hour urine collection.

2.2 Sample design

2.2.1 Selecting addresses

The sample was drawn from the PAF. The aim was to achieve 200 fully productive individuals (100 adults, 100 children) in Northern Ireland in each survey year (so 400 adults and 400 children for Years 1 to 4 combined). To this end, 648 addresses were randomly selected from 24 PSUs each year⁷ (27 addresses per PSU) yielding a total of 2,619 addresses in 97 PSUs for Years 1 to 4 combined.⁸

At each address, the interviewer established the number of households and, in cases where there were two or more, selected one household at random.

2.2.2 Selecting participants

To determine whether an adult (aged 19 years or over) and a child (aged 1.5 to 18 years),⁹ or a child only, were selected for interview the 27 addresses in each PSU were randomly allocated to one of two groups as follows.

<u>Survey year</u>	<u>No. addresses at which adult and child selected ('basic' addresses)⁹</u>	<u>No. addresses at which child only selected ('child boost' addresses)</u>
1	9	18
2	9	18
3	9	18
4 (quarters 1,2)	11	16
4 (quarters 3,4)	10	17

The split was changed in Year 4 with the aim of increasing the number of child participants in order to ensure that the target numbers were achieved over the four years. In households containing more than one eligible person (adult and/or child), interviewers selected the participant(s) using a random selection procedure.

Further details on sampling can be found in Appendix B.

2.3 Ethics approval

Ethics approval for the UK study as a whole was obtained from the Oxfordshire A Research Ethics Committee. The letters of approval for the original submission and subsequent substantial amendments, together with approved documents, were sent to all Local Research Ethics Committees (LRECs) covering areas where fieldwork was being conducted. Research governance¹⁰ approval was sought for all participating NHS laboratories and obtained where required by the Research and Development (R&D) Committee for each laboratory.

2.4 Fieldwork

Years 1 to 4 of NDNS RP fieldwork was issued to fieldworkers as follows:

<u>Survey year</u>	<u>Fieldwork period</u>
Year 1 ¹¹	April 2008- March 2009
Year 2	April 2009 - June 2010
Year 3	April 2010 - June 2011
Year 4	April 2011 - June 2012

In each survey year, fieldwork was issued monthly to interviewers and nurses in the following waves:

<u>Wave</u>	<u>Interviewers (Stage 1)</u>	<u>Nurses (Stage 2)¹²</u>
Quarter 1	April-June	July-September
Quarter 2	July-September	October-December
Quarter 3	October-December	January-March
Quarter 4	January-March	April-June

Fieldwork took place throughout the year to take account of any seasonality effect. Stage 1 fieldwork commenced on the first weekday of the month, and interviewers were given six weeks in which to complete their assignment. Stage 2 fieldwork for a particular month started six weeks after the interviewer deadline (for example, interviewers completed April assignments by mid-May and nurse visits to these participants started in July).¹² Nurses had up to seven weeks to complete their work.

2.5 Overview of survey components and fieldwork procedures

There were two main stages to the survey:

Stage 1: Interviewer visit: Four-day food diary

Detailed background interview

Interview with MFP

Height and weight measurements

Smoking and drinking self-completion

questionnaires

Physical activity self-completion questionnaire or

physical activity monitor (ActiGraph)

Doubly labelled water sub study (Years 1 and 3,
core UK sample, only)¹³

Stage 2: Nurse visit: Blood sample

24-hour urine collection

Physical measurements

Blood pressure

Collection of information about prescribed medicines

2.5.1 Stage 1: the interviewer visits

A letter and leaflet describing the purpose of the survey was sent to all sampled addresses before the fieldwork start date. A few days later, interviewers visited the addresses to determine whether the address was private, residential and occupied. They then carried out the selection process and, for children aged under 16 years, sought both the child's and their parent's (or guardian's) consent to interview.

Interviewers carried out three main visits to households who agreed to participate:

- **Visit 1:** Four-day food diary explained to the participant and left with them to complete; interviewer-administered CAPI; height and weight measurements; self-completion booklets in which children and young people were asked to record their smoking and drinking habits. Participants aged 16 years and above were asked to fill in a self-completion questionnaire designed to collect information about physical activity (the Recent Physical Activity Questionnaire (RPAQ)).¹⁴ Children aged 4 to 15 years¹⁵ were

asked whether they would be willing to wear a physical activity monitor (an ActiGraph) for seven consecutive days (the monitor was explained and left with those who agreed to wear it).

- **Visit 2:** The diary check up visit where the interviewer reviewed the completion of the four-day food diary so far and filled in any missing information with the participant.
- **Visit 3:** Review and collection of four-day food diary, RPAQ self-completion and ActiGraph and further CAPI questionnaire administration.¹³

At the end of the third main interviewer visit, interviewers gave each participant completing at least three food diary recording days a token of appreciation (£30 in high street vouchers, reduced from £40 from Year 1, quarter 3 onwards in order to help fund a new token of appreciation for participants providing a blood sample).¹⁶ Interviewers then introduced the second stage of the survey, asking for permission for the nurse to visit.

Further details about information collected during the interviewer stage (and the fieldwork documents used) can be found in Appendices C to F.

2.5.2 Computer Assisted Personal Interview (CAPI) programme

CAPI interviewing involves the interviewer reading questions from a laptop screen and entering the participants' responses into designated fields. The CAPI questionnaire had three main elements: household composition/ structure interview, MFP interview and individual interview. The individual questionnaire, asked of each selected participant had two parts: Part 1, which was asked at the first main interviewer visit; and Part 2, which was asked at the third main visit after the interviewer had collected the food diary.

The content of the CAPI questionnaires is shown in Appendix D.

2.5.3 Collection of dietary data: the four-day food diary

Based on the day of the first individual CAPI interview, the interviewer's laptop program selected four consecutive days as the food diary recording period. Participants were provided with a diary and asked to keep a record of everything they ate and drank over these four days, both in and outside the home.

Interviewers carried out a food diary check visit with participants on the second or third day of recording either in person or over the telephone, with the aim of improving recording for the remaining days and also providing encouragement to participants to continue recording. Interviewers then returned to collect the diary and check the remaining days no later than three days after the final day of recording.

As participants were not expected to weigh their food and drink, portion sizes were estimated using household measures (e.g. two thick slices of bread, four tablespoons of peas) or using weights from labels (e.g. 420g tin of baked beans, 330ml can of lemonade). Those aged 16 years and over were also able to describe their portion size using photographs of 10 frequently consumed foods reproduced in the diary. To improve the accuracy of recording of children's food portion sizes, three age-appropriate versions of a 'Young persons food photograph atlas' were introduced from Year 4 for use during the diary review process. The atlases presented a range of served and leftover portion sizes for 44 commonly consumed foods for which portion size estimation is difficult. Interviewers asked participants to select the appropriate portion sizes for all diary entries represented in the atlas.

A parent was asked to keep the food diary on behalf of participants aged 11 years and younger, with the child contributing information where possible and with help from other carers.

Appendix A provides full details of the dietary data collection and processing protocols.

2.5.4 Selection of food diary start day

In Year 1, the recording period always started on a Thursday, Friday or Saturday and included both weekend days (Saturday and Sunday). This meant that weekend days were over-represented and Wednesdays were never represented. To redress the over-representation of weekend days and non-representation of Wednesdays in Year 1, the food diary recording period was changed from Year 2 onwards so that all days of the week would (as far as possible) be equally represented.

The study design aimed to give an even representation of diary days on all days of the week so the food diary could start on any day of the week and run for four consecutive days. The diary start day for each participant was assigned by the CAPI program but could be changed by the interviewer if the participant preferred a different day.

Further information about the food diary can be found in Chapter 5, section 5.1.

2.5.5 Collection of physical activity data

The objective physical activity measurements were obtained through the use of a device called an accelerometer - the ActiGraph. This provides a measure of the frequency, intensity, and duration of physical activity and allows classification of activity levels as sedentary, light, moderate and vigorous.

In Year 1, all children aged 4 to 10 years were asked to wear an Actigraph. In Years 2 to 4, all children aged 4 to 15 years were asked to do so.

Children were asked to wear the ActiGraph, on a belt above the right hip, during waking hours for seven consecutive full days. At the end of the first CAPI interview, interviewers obtained agreement for participation in this element of the study, provided the ActiGraphs and explained procedures. The protocols used for the placement are provided in Appendix G.

All children who wore an ActiGraph for seven consecutive days received a £10 high street voucher as a token of appreciation.¹⁶

Further information about the objective measurement of physical activity and the use of ActiGraphs can be found in Chapter 4, section 4.3.3.

2.5.6 Stage 2: the nurse visit

Stage 2 of the survey was carried out by a qualified nurse and took place within two to four months of the final interviewer visit.¹² All individuals completing three or four food diary days were eligible for a nurse visit.

At the end of Stage 1, interviewers provided participants with information leaflets giving details of the nurse visit. Nurses could provide these again if necessary. The nurse asked questions about prescribed medications before taking, with agreement, a number of physical measurements.

2.5.7 Measurements taken by the nurse

A summary of the information collected during the nurse stage is provided below. Some of the information collected by nurses was limited to particular age groups.

<u>Measurement or procedure</u>	<u>Participant</u>
Details of prescribed medications	All ages
Blood pressure	Aged four years and over
Infant length measurement	Aged 18 to 23 months
Waist and hip circumferences	Aged 11 years and over
Demispan	Aged 65 years and over and those aged 16 to 64 years where height could not be measured
Mid Upper Arm Circumference (MUAC)	Aged 2 to 15 years
24-hour urine collection	Aged four years and over fully out of nappies
Non-fasting blood sampling	Aged 1.5 to 3 years; diabetics not willing to fast
Fasting blood sampling	Aged four years and over

The nurse fieldwork documents are provided in Appendices H and I. Measurement protocols are provided in Appendix L.

2.5.8 Blood sampling

After providing the physical measurements, participants were asked whether they were willing to give a small blood sample by venepuncture after an overnight fast (those aged 1.5 to 3 years and diabetics not willing to fast were asked whether they were willing to provide a non-fasting blood sample). The nurse obtained written consent from participants aged 16 years and over before the sample was taken. For children aged 1.5 to 15 years, written consent of a parent or guardian was required and nurses additionally obtained the assent of the child where possible. For those aged 10 years or younger, blood was taken by a paediatric phlebotomist who accompanied the nurse on the visit.¹⁷ Nurses also sought written agreement to store part of the blood sample for additional analyses at a future date. Participants who provided a blood sample were given £15 in high street vouchers as a token of appreciation for agreeing to this part of the study.¹⁸

2.5.9 24-hour urine collection

Nurses also sought agreement from adult participants, and child participants aged four years and over who were fully out of nappies (and their parent or guardian), to provide a 24-hour urine collection. If participants agreed, they were asked to take three para-aminobenzoic acid (PABA) tablets evenly spaced throughout the waking hours of the day on which the 24-hour urine sample was collected, in order to assess the completeness of the urine collections.

Written consent was sought for the taking of PABA tablets, laboratory analysis of the 24-hour urine sample and storage of any remaining urine for future analyses. Participants who provided a 24-hour urine sample were given £10 in high street vouchers as a token of appreciation for taking part in this element of the study.

2.5.10 Feedback to participants and GPs

Participants who completed three or four food diary recording days were asked whether they would like to be sent feedback on the analysis of their diary and how this compared to nutrient intake recommendations. The feedback also included general information on sources of healthy eating advice. Further information about the dietary feedback can be found in Appendix A and an example of the dietary feedback is provided in Appendix M.

Each participant was also given a 'Measurement Record Card' on which the interviewer and nurse recorded the person's height, weight, body mass index (BMI) (if aged 16 years and over), blood pressure (if aged four years and over) and other age-dependent anthropometric measurements: waist and hip circumferences (ages 11 years and over); mid upper arm circumference (MUAC) (aged 2 to 15 years); demispan measurement (aged 65 years and over) and infant length (aged 18 to 23 months). Participants who provided a blood sample were additionally asked whether they wished to be sent results of the blood sample analyses most related to their health. Participants were asked if they wanted details of these analyses, their BMI and their blood pressure readings to be sent to their GP. If they did, written consent was obtained from the individual (or from the parent in the case of a child). See Appendix M for an example of feedback to GPs.

2.6 Fieldwork quality control

2.6.1 Project specific training for interviewers and nurses

Fieldwork in Northern Ireland was carried out by the Northern Ireland Statistics and Research Agency (NISRA) panel of interviewers and nurses.¹⁹ All fieldwork procedures and documents were the same as those used by NatCen fieldworkers in the rest of the UK.

All interviewers and nurses working on the NDNS RP were briefed and trained before undertaking an assignment and were monitored during their assignment. Fieldworkers were also issued with comprehensive written instructions covering survey procedures and measurement protocols.

2.6.2 Training for interviewers

In Year 1 all NDNS RP interviewers attended a three-day training course where they were fully briefed on the protocols and administration of the survey. In Years 2 to 4 all new-to-NDNS RP interviewers and those who had previously worked on the NDNS RP but not in the preceding year attended a two-day training course. Interviewers who had worked in the previous year of the NDNS RP attended a one-day refresher briefing.

The full and refresher briefing sessions covered background and content, doorstep approach, questionnaire administration (including practice sessions), placement and collection of self-

completions and ActiGraphs and the placement, checking and collection of the four-day food diaries. In Year 4, interviewers who had not been trained in measuring heights and weights were asked to attend an additional 'accreditation' day which focussed on how to take accurate measurements.

After the briefing, 'early work' checks were carried out on the first two or three food diaries returned by each interviewer with timely feedback provided on any areas of concern. Before working on a second or subsequent assignment, all interviewers received feedback on the diaries from their previous assignment. Further, any interviewer who had more than three months gap between assignments completed their own two-day diary which was reviewed and comments fed back.

2.6.2 Training for nurses

Nurse briefings lasted one and a half days and covered equipment training, blood sampling and 24-hour urine collection training and questionnaire administration (including practice sessions). Nurses were also briefed on the demispan, MUAC and infant length measurement protocols (i.e. the physical measurements less regularly taken on other surveys). All other physical measurements were either regularly taken by nurses on the NDNS RP or the newer nurses attended a general training session which covered these protocols.

Nurses who had a gap of three months or more between assignments and new-to-NDNS RP nurses completed three homework exercises which were marked and individual feedback given to each nurse prior to starting their assignment.

2.7 Key methodological changes between survey years

The main methodological changes were introduced during Years 1 to 4 of the NDNS RP as follows:

- Collection of physical activity data was reviewed during year 1 by a working group including physical activity experts from the MRC Epidemiology Unit. Based on recommendations of the working group, the use of the physical activity monitor (the 'ActiGraph') was extended from children aged 4 to 10 years in Year 1 to children aged 4 to 15 years in Year 2 onwards. Those aged 16 years and

older were asked to complete a physical activity self-completion questionnaire which was shorter than the questionnaire used in Year 1. There was no change from Year 1 for those aged 4 to 10 years who continued to be asked to wear an ActiGraph.

- In Year 1, the nurse visit followed as soon as possible after the interviewer visits were completed. In Year 2 onwards, a longer gap was introduced with the aim of improving nurse stage response rates. The nurse visit took place between two to four months after the interviewer visits to the household had been completed.
- The DLW sub-study took place in alternate fieldwork years (i.e. Years 1 and 3) so there was no DLW sub-study in Year 2 or Year 4 of the NDNS RP.
- In Year 1, the dietary recording period included both weekend days (Saturday and Sunday). In Year 2 onwards, the diary recording period started on any weekday or weekend day and aimed to give an even representation of diary days on all days of the week.
- A question was introduced in the Year 3 CAPI interview to find out whether households were in receipt of Working Families' Tax Credits, Income Support or Income-Related Job Seekers Allowance.
- The 'Young persons food photograph atlases' were introduced in Year 4 (following feasibility testing in Year 3, quarter 2) as a tool to improve the accuracy of portion sizes for participants aged under 16 years (see Appendix A for further information).

These methodological changes did not affect the way the rest of the data were collected, analysed or interpreted.

2.8 Response rates

Response rates presented in this section are for Years 1 to 4 combined. See Appendix B for more information on sampling design.

2.8.1 Household level response

Overall for Years 1 to 4 combined, of the 2,619 (core and country boost addresses) issued to interviewers in Northern Ireland, 46% were eligible for household selection and 54% were ineligible. Ineligible addresses include vacant or derelict properties/institutions. Addresses that were selected for the 'child boost' and were screened out because they did not contain any children in the eligible age range were also included in the ineligible category. This explains the higher than average proportion of ineligible addresses.

Household selection was carried out at 90% of eligible addresses. The remaining 10% of addresses refused before the household selection could be carried out. Of eligible households, 73% were productive – i.e. at least one selected participant completed three or four dietary recording days.²⁰

(Table 2.1)

2.8.2 Individual level response

The overall response rate for fully productive individuals (i.e. those completing three or four dietary recording days) was 64% for Years 1 to 4 combined (56% in Year 1, 63% in Year 2, 68% in Year 3 and 64% in Year 4), giving a sample size of 982 fully productive individuals.²⁰ Analyses in this report (including response rates for subsequent stages/components of the survey) are based on these 982 individuals.

Valid height and weight measurements were obtained for almost all fully productive participants (height 96%; weight 96%).

Seventy-five per cent of all fully productive participants were visited by a nurse.²¹

Physical measurements including waist and hip circumference, MUAC and blood pressure were taken from almost all participants (adults and children) who had a nurse visit.

Fifty-six per cent of fully productive adults and 20% of fully productive children (i.e. those completing at least three diary days) provided a blood sample.²²

Sixty-four per cent of fully productive participants aged four years and over²³ went on to provide a 24-hour urine sample (65% of adults, 63% of children). Samples were assessed for completeness; a proportion were found to be incomplete and therefore not usable for the analysis (see chapter 7).

In Year 1, all children aged 4 to 10 years were asked to wear an ActiGraph. In Years 2 to 4, all children aged 4 to 15 years were asked to do so. Across all years interviewers placed an ActiGraph with 82% of eligible children and usable ActiGraph data was collected from 40% of eligible children.

(Table 2.2)

2.9 Weighting the survey data

It is necessary to apply weighting factors to the data collected in the NDNS RP for two reasons: to remove any bias in the observed results which may be due to differences in the probability of households and individuals being selected to take part; and to attempt to reduce non-response bias.

The survey was designed so that no more than one adult and one child were selected to take part from any one household. This meant that adults living in households with one or more other adults, and children in households with one or more other child were less likely to be selected than were adults or children in single adult/child households.

In addition, the multi-stage design means there were a number of stages in the survey where it was possible for participants to drop out. If the people who refused to participate at a particular stage were systematically different from those who took part then the sample would be biased.

Weighting factors were used to correct for both these cases. There were two stages to the weighting scheme: the first was to generate a set of design weights to correct for the unequal selection probabilities; and the second was to create a set of weights to adjust for non-response. The final weights were a product of the selection weights and the non-response weights.

The weighted sample is representative of the Northern Ireland population living in private households.

Full detail of the NDNS RP weighting scheme is provided in Appendix B.

¹ Boost samples were also drawn in Scotland (Years 1-4) and Wales (Years 2-4).

² The sample was drawn from the 'small users' sub-file of the Postcode Address File (PAF). This is a computer list, prepared by the Post Office, of all the addresses (delivery points) which receive fewer than 25 articles of mail a day.

³ A guardian is defined as a person with legal responsibility for the child.

⁴ The Main Food Provider (MFP) is the person in the household with the main responsibility for shopping and preparing food. If these tasks were shared equally between two people, for example if one person did all the shopping and another person did all the cooking, then either resident could be classified as the MFP.

⁵ The 'Household Reference Person' (HRP) was defined as the householder (a person in whose name the property is owned or rented) with the highest income. If there was more than one householder and they had equal income, then the eldest was selected as the HRP.

⁶ Questions were asked to ascertain whether the HRP was in paid work at the time of the interview and, if not, whether they had ever had a paid job. If the HRP had ever worked, there were further questions about their current or most recent job in order to classify HRPs into the National Statistics Socio-economic Classification (NS-SEC) groupings.

⁷ One additional PSU was selected for the Run In. See endnote reference 11.

⁸ 432 addresses in 16 PSUs were in the core UK sample; 2,160 addresses in 80 PSUs formed the Northern Ireland boost sample and one PSU with 27 addresses was in the Run In.

⁹ In these households, the aim was to select and interview an adult AND a child. However, if no child was resident, the interviewer selected and interviewed one adult.

¹⁰ The Research Governance Framework is intended to define the broad principles of good research practice, and to ensure that health and social care research is conducted to high scientific and ethical standards.

¹¹ Before the main study launched in April 2008 there was final test of procedures and protocols called the Run In. It consisted of ten PSUs across the UK issued over two months. The Run In sample was drawn in the same way as the NDNS Year 1 core sample and fieldworkers followed the same protocols and procedures as in the mainstage (quarters one to four). The Run In results have therefore been combined with the mainstage data and included in this report.

¹² In Year 1, the nurse visit followed as soon as possible after the interviewer visits were completed. In Year 2, a longer gap was introduced with the aim of improving nurse stage response rates. The nurse visit for Years 2 to 4 took place between two to four months after the interviewer visits to the household had been completed.

¹³ A sub-sample of participants were recruited for a Doubly Labelled Water (DLW) sub-study to measure energy expenditure. The DLW sub-study took place in alternate fieldwork years (i.e. Years 1 and 3) so there was no DLW sub-study in Years 2 and 4.

¹⁴ Based on the Recent Physical Activity Questionnaire developed by the MRC Epidemiology Unit, Cambridge.

¹⁵ In Year 1, children aged 4 to 10 years were asked to wear an ActiGraph. From Year 2 onwards, the age range was extended to include those aged 11 to 15 years.

¹⁶ Children who had worn an ActiGraph were given a promissory note stating that their £10 token of appreciation would be sent from the office within four weeks of interview.

¹⁷ Nurses qualified and experienced in paediatric phlebotomy took blood samples from children.

¹⁸ This was introduced from Year 1, quarter 3 onwards.

¹⁹ NISRA do not maintain a panel of nurses, nurses were recruited to work specifically on the NDNS RP.

²⁰ Of the 982 fully productive individuals, 969 (99%) completed four dietary days and 13 (1%) completed three days.

²¹ The remainder of fully productive respondents either refused to progress to stage 2 or, in a small number of cases, could not be visited during the nurse fieldwork period.

²² Blood sampling response rates for children varied by age group. Blood was obtained from 41% of children aged 11 to 18 years and 3% of those aged 4 to 10 years. No blood samples were obtained from children in the youngest age group (i.e. those aged 1.5 to 3 years). This pattern mirrors the experience in the rest of the UK but was also exacerbated in Northern Ireland by the lack of a paediatric phlebotomist available to take blood samples from younger children.

²³ Participants also had to be fully out of nappies to be eligible for the 24-hour urine collection element.

3 Socio-demographic characteristics of the NDNS RP sample

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3.1 Introduction

This chapter describes the socio-demographic and health-related lifestyle characteristics of the NDNS RP Northern Ireland sample for Years 1 to 4 combined, using data collected during the CAPI interviews and from self-completion questionnaires in the case of smoking and drinking analysis.

3.2 Sex

In the unweighted NDNS RP Northern Ireland sample, 37% of adults (aged 19 years and over) were men and 63% were women, while for children (aged 1.5 to 18 years) 51% were boys and 49% were girls. The sample was weighted to reflect the distribution of males and females in the general population within Northern Ireland.¹

(Table 3.1)

3.3 Age

The unweighted NDNS RP Northern Ireland sample of adults comprised 83% aged 19 to 64 years and 17% aged 65 years and over. The unweighted sample of children included 18% aged 1.5 to 3 years, 36% aged 4 to 10 years and 46% aged 11 to 18 years. The sample was weighted to bring the proportions in line with the age profile of the Northern Ireland general population.¹

(Tables 3.2 and 3.3)

All text and tables in the remainder of this report use weighted data to present a representative sex and age profile of the Northern Ireland population.

3.4 National Statistics Socio-economic Classification (NS-SEC), housing tenure, education and qualifications

Participants were assigned a socio-economic classification based on the employment of the Household Reference Person (HRP) for their household (see section 2.1 for HRP definition).

In terms of the HRP's current or most recent job, the proportion of participants' households² classified to the main NS-SEC occupational groupings are similar to those reported in the latest (2011) Northern Ireland census.¹

Participants were categorised according to the housing tenure of the HRP. Around three-quarters of participants (75% adults, 69% children) lived in owner occupied accommodation. Twelve per cent of adults and 18% of children lived in social housing. A further 13% of adults and 14% of children lived in privately rented accommodation. These proportions are in line with those found in the Northern Ireland population.¹

Participants aged 16 years and over were asked the age at which they had left full-time education. Less than half (45%) reported that they had left school by the age of 16 years but the proportion having done so was much higher amongst older adults (75% of those aged 65 years and over had left school by the age of 16 years).

(Table 3.4)

If participants had finished full-time education they were asked the highest qualification (if any) they had achieved. Older adults aged 65 years and over were less likely than other adults to have a degree (7% compared with 14% of those aged 50 to 64 years, 24% of those aged 35 to 49 years and 17% of those aged 19 to 34 years). Conversely, the proportion of those having no qualifications increased with age: 6% of those aged 16 to 18 years had no qualifications compared with 61% of those aged 65 years and over.

(Table 3.5)

3.5 Vegetarian and vegan diets

One per cent of both adults and children reported that they were vegetarian; and no participants reported following a vegan diet.³

(Table 3.6)

3.6 Smoking

Of those aged 16 years and over, 27% of men and 21% of women reported that they were current smokers. These proportions are similar to those reported in the Health Survey Northern Ireland 2011-12⁴ (where 25% of men and 23% of women were categorised as current smokers).

(Table 3.7)

Those who reported that they were current smokers were asked how many cigarettes they smoked on an average week and weekend day. Twelve per cent of men and 6% of women were classed as heavy smokers (i.e. they smoked 20 or more cigarettes per day).

(Table 3.8)

Information about experience of smoking was collected for children aged 8 to 15 years of age. Overall, 11% of both boys and girls in this age group⁵ reported having ever smoked a cigarette. This is in line with the findings of the Young Persons' Behaviour and Attitudes Survey (YPBAS) 2010.^{6,7}

(Table 3.9)

3.7 Alcohol consumption

3.7.1 Drinking behaviour amongst adults aged 16 years and older

The recommended sensible drinking guidelines for Northern Ireland (and the UK as a whole) are that men should not regularly drink more than three to four units of alcohol per day, and women should not regularly drink more than two to three units of alcohol per day. Men who regularly drink more than eight units a day (or 50 units a week) and women who regularly drink more than six units a day (or 35 units a week) are considered to be at particular risk of harm.⁸

Alcohol consumption is reported in terms of units of alcohol; one unit of alcohol is 10ml by volume of pure alcohol.⁹ Daily consumption is calculated by recording the amounts drunk on the day in the past week when the participant drank most.

More than half of men (57%) and half of women (50%) had drunk alcohol in the last week, including 45% of men and 28% of women who had drunk more than twice the recommended levels on at least one of these days.

(Table 3.10, Table 3.11)

On average among those who drank in the last week, men aged 25 to 49 years consumed 10.6 units on the day they drank most in the last week and women in the same age group consumed 6.9 units. Mean units of alcohol consumed by men and women exceeds the definition of binge drinking.

(Table 3.11)

3.7.2 Drinking behaviour amongst children aged 8 to 15 years

In 2009, the Department of Health published guidance from the Chief Medical Officers of England, Wales and Northern Ireland on the consumption of alcohol amongst children and young people.¹⁰ It emphasises that an alcohol-free childhood is the healthiest option. The advice also recommends that parents should try to ensure that their children do not drink alcohol, at least up to the age of 15 years. Furthermore, it advises that young people aged 15 to 17 years should never exceed recommended adult daily limits and, on days when they drink, consumption should be below such levels.¹⁰

A higher proportion of girls (25%) than boys (17%) aged 8 to 15 years reported ever having had a proper alcoholic drink (not just a taste).^{11, 5} These proportions are broadly in line with YPBAS 2010 results.⁶

(Table 3.12)

Attempting to accurately measure alcohol consumption among children can be challenging. Recall of their drinking can be erroneous; a generally acknowledged problem for all surveys measuring alcohol consumption. Further, the majority of childrens' drinking is in informal settings, and the quantities they drink are not necessarily standard measures. This should be borne in mind when interpreting the figures in Tables 3.12 and 3.13.

¹ Northern Ireland Statistics and Research Agency (NISRA), 2013
http://www.nisra.gov.uk/Census/2011_results.html (accessed 23/10/2014).

² Some households contained both an adult and a child participant. Such households and their HRP will be represented in both the adult and child figures.

³ Self-reported assessment via question in the CAPI interview.

⁴ Health Survey Northern Ireland 2012. <http://www.northernireland.gov.uk/index/media-centre/news-departments/news-dhssps/news-dhssps-151111-health-survey-northern.htm> (accessed 23/10/2014).

⁵ Numbers are too small to report percentages for smaller age groupings.

⁶ Young Persons' Behaviour and Attitudes Survey (YPBAS) 2011. <http://www.csu.nisra.gov.uk/survey.asp96.htm> (accessed 23/10/2014).

⁷ Note that results are not directly comparable with YPBAS (2010) as age groupings differ in the two surveys.

⁸ Department of Health (2007)
http://webarchive.nationalarchives.gov.uk/+www.dh.gov.uk/en/Publichealth/Alcoholmisuse/DH_125368 (accessed 23/10/2014).

Drinking at this level has been described in surveys, including the Health Survey for England, as 'binge drinking'. 'Binge drinking' is also used to define a pattern of drinking a large quantity of alcohol in a short period with the aim of getting drunk. In practice, this may involve considerably more than twice the recommended daily limits. To avoid confusion, the term 'binge drinking' is not used in this report.

⁹ Adults (i.e. those aged 16 years or older) who drank bottled or canned beer, lager, stout or cider were asked in detail about what they drank, and this information was used to estimate the amount in pints (one pint is equivalent to 0.568 litres). Adults were also asked to quantify the amount of wine drunk in terms of large (250ml), standard (175ml) and small (125ml) glasses, and were also given the option of specifying the quantity of wine drunk in bottles or fractions of a bottle; a bottle was treated as the equivalent of six small (125ml) glasses. Adults who drank spirits were asked to quantify how much they drunk in single measures (25ml).

¹⁰ <http://www.drinkaware.co.uk/> (accessed 23/10/2014)

¹¹ Children are likely to under-report their alcohol consumption (frequency and amount drunk) in home-based surveys because they may be worried about parents seeing their answers. This should be borne in mind when interpreting the findings presented in this section.

4 Physical measurements and physical activity

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4.1 Physical measurements

4.1.1 Introduction

Height and weight measurements, from which body mass index (BMI) was calculated, were taken during Stage 1 (the interviewer visit). Waist and hip circumference and blood pressure were measured during Stage 2 (the nurse visit).¹ Comparisons were made, where possible, with data on physical measurements from both the NDNS UK sample and other surveys conducted in Northern Ireland.^{2,3} Data presented are for Years 1 to 4 combined (2008/09 to 2011/12).

Detailed descriptions of the measurement protocols used in the NDNS RP are available in Appendix I but a brief description is provided within each section below.

4.1.2 Anthropometry measurements

Height and weight were measured at the first interviewer visit, using a portable stadiometer, measuring to the nearest 0.1cm (and if between two mm, rounded to the nearest even mm) and weighing scales, measuring to the nearest 0.1kg. BMI = weight (kg) / height squared (m²) was calculated by the interviewer's CAPI programme. For adult participants whose height could not be measured, estimated height based on demispan⁴ was used to calculate BMI.⁵ For children aged 1.5 to 2 years, the nurse measured length instead of height and this measurement was used in place of height when calculating BMI for these youngest children.⁶ The nurse measured waist and hip circumferences in those aged 11 years and over using an insertion tape measure.⁷

4.1.3 Obesity

4.1.3.1 Adults

Table 4.1a shows mean BMI and BMI status, in adults, by age group and sex (according to the World Health Organization (WHO)⁸ and National Institute for Health and Care Excellence (NICE) classification⁹ as shown below:

BMI classification	
<i>BMI (kg/m²)</i>	<i>Description</i>
Less than 18.5	Underweight
18.5 to less than 25	Normal
25 to less than 30	Overweight
30 or more	Obese
40 or more	Morbidly obese

This report uses the same BMI classification as used in the NDNS UK report² which facilitates comparisons between Northern Ireland and the UK as a whole.

An adult was classified as having abdominal obesity if their waist circumference was greater than 102cm for men and greater than 88cm for women, or if their waist: hip ratio (WHR) was greater than 0.95 for men and greater than 0.85 for women.¹⁰

Overall, mean BMI was the same for men and women (27.6 kg/m²). A higher percentage of men (73%) than women (61%) were overweight, including obese (i.e. BMI \geq 25kg/m²) but there was no significant difference between men and women in the prevalence of obesity (28% in both sexes).¹¹

Overall, mean waist circumference was significantly higher in men than women (98.5cm and 92.3cm respectively). However, a higher percentage of women (56%) than men (30%) had a raised waist circumference. Similarly, mean WHR was significantly higher in men than women (0.93 and 0.86 respectively) but a higher percentage of women (59%) than men (35%) had a raised WHR.

(Table 4.1a)

4.1.3.2 Children

In the UK, the current growth charts are a combination of the World Health Organization (WHO) growth standards for children from birth to four years, and the UK 1990 reference values for older children. New UK World Health Organization (WHO) growth charts for children from birth to four years were introduced for all new births in Northern Ireland from May 2009.¹² These are based on WHO Growth Standards from data in infants who were exclusively or predominantly breastfed.^{13, 14}

Growth standards for the youngest children are based on breastfed babies,^{14,15} who tend to have a different pattern of growth compared with formula-fed infants, whereas growth standards for older children are based on the growth of UK children regardless of feeding (UK 1990 reference values).¹⁴

For clinical purposes, the charts define overweight as above the 91st but on or below the 98th centile for BMI and obesity as above the 98th centile. However, this report uses the 85th and 95th centiles to define overweight and obesity, as is standard Northern Ireland and UK government practice for population monitoring.¹⁶

A similar proportion of boys and girls were obese (20% and 18% respectively). However a higher proportion of boys than girls were overweight (21% and 13% respectively) and overweight, including obese (41% of boys and 31% of girls). BMI in children can be useful as an indicator of over- or under-nutrition, but must be interpreted carefully and compared with suitable age- and sex-specific thresholds for defining normal / abnormal categories.¹⁷

(Table 4.1b)

4.1.4 Comparisons with other surveys

Comparisons of results for adults¹⁸ in the NDNS RP Northern Ireland sample with adults in the NDNS RP UK sample² and, where possible, adults in the 2011/12 Health Survey Northern Ireland³ showed that anthropometric measurements were broadly similar.

Mean BMI was slightly higher in women in the NDNS RP Northern Ireland sample (27.6kg/m²) than in the NDNS RP UK sample (27.4kg/m²). Among men, mean BMI was the same in both surveys (27.6kg/m²). Mean BMI was not reported in the 2011/12 Health Survey Northern Ireland.

The proportion of overweight adults was similar across surveys. Among men it was 45% in both the NDNS RP UK and NDNS RP Northern Ireland samples and 42% in the 2011/12 Health Survey Northern Ireland. In women, the proportion was 29% in the NDNS UK sample and 34% in both the NDNS RP Northern Ireland sample and 2011/12 Health Survey Northern Ireland.

Among men the proportion of obese adults was also similar in the three surveys (28% in the NDNS RP Northern Ireland sample, 26% in the NDNS RP UK sample and 25% in the 2011/12 Health Survey Northern Ireland). In women the proportion was similar in the NDNS RP UK and NDNS RP Northern Ireland samples (29% and 28% respectively) but it was lower in the 2011/12 Health Survey Northern Ireland (22%). It should be noted that these comparisons were not formally tested for statistical significance.

Mean waist circumference was similar in men in the NDNS RP UK and NDNS RP Northern Ireland samples (98.3cm and 98.5cm respectively) but was higher in women in the NDNS RP Northern Ireland sample (92.3cm) compared with the NDNS RP UK sample (88.7cm). The proportion of adults with a raised waist circumference was lower in men in the NDNS RP Northern Ireland sample (30%) compared with the NDNS RP UK sample (37%) but higher in women (56% and 46% respectively).

In men, mean WHR was 0.93 in both the NDNS RP UK and NDNS RP Northern Ireland samples. Mean WHR was slightly higher in women in the NDNS RP Northern Ireland sample (0.86) than in the NDNS RP UK sample (0.83). The proportion of men with a raised WHR was 35% in the NDNS RP Northern Ireland sample and 39% in the NDNS RP UK sample; equivalent figures in women were 59% and 38%. It should be noted that these comparisons were not formally tested for statistical significance. Waist circumference and WHR were not measured in the 2011/12 Health Survey Northern Ireland.

The prevalence of obesity in boys appeared to be slightly higher in the NDNS RP Northern Ireland sample (20%) than in the NDNS RP UK sample (17%) but was similar in girls (18% and 19% respectively).¹⁹

4.2 Blood pressure

4.2.1 Measurement of blood pressure

Blood pressure was measured in a sitting position using an automated, validated machine, the Omron HEM907, after a five minute rest. Results presented in this chapter are based on the mean of the second and third readings, taken at one minute intervals, in participants with valid readings (i.e. three readings in people who had not eaten, drunk alcohol, smoked or exercised for at least 30 minutes prior to measurement). Full details of protocols are available in Appendix I.

Hypertension was defined as a systolic blood pressure of 140mmHg or above, and/or diastolic blood pressure of 90mmHg or above,²⁰ and/or taking medication specifically to reduce blood pressure.

4.2.2 Results

Table 4.2 shows mean systolic (SBP) and diastolic (DBP) blood pressure for adults, by age and sex, together with the proportion of participants whose blood pressure results indicated hypertension, and whether this was treated and/or controlled.²¹

Mean SBP was significantly higher in men (130.8mmHg) than women (126.0mmHg) but there were no differences in mean DBP (73.0mmHg and 74.0mmHg respectively). Hypertension levels were higher in men than women (35% and 29% respectively) but the proportion of men and women on treatment for hypertension (i.e. controlled or uncontrolled hypertension)²² was similar (11% and 10% respectively).

(Table 4.2)

4.2.3 Comparisons with other surveys

Mean SBP and DBP levels in men were similar in the NDNS RP Northern Ireland and the NDNS RP UK samples (130.8 and 73.0mmHg in Northern Ireland; 130.2 and 74.7mmHg in the UK). Among women, mean SBP and DBP levels in the NDNS RP Northern Ireland sample were 126.0 and 74.0mmHg, similar to the levels for women in the NDNS RP UK sample (124.8 and 73.4mmHg).

The proportion with hypertension was similar in the two surveys. Among men it was 35% in the NDNS RP Northern Ireland sample and 32% in the NDNS RP UK sample. In women the proportions were 29% and 28% respectively.

Blood pressure data was not collected in the 2011/12 Health Survey Northern Ireland.

4.3 Physical activity

4.3.1 Introduction

Physical activity was assessed in different ways for children (aged 4 to 15 years) and adults (aged 16 years and over).

Children's physical activity was measured using accelerometers (ActiGraphs) during Stage 1 (the interviewer visits). In Year 1 children aged 4 to 10 years were asked to wear an ActiGraph. In Years 2 to 4, use of the ActiGraph was extended to include those aged 11 to 15 years.

In Years 2 to 4, a self-completion questionnaire - the Recent Physical Activity Questionnaire (RPAQ), developed by the MRC Epidemiology Unit Cambridge,²³ was used to estimate physical activity in participants aged 16 years and over (deemed 'adults' in this section) from Year 2 onwards. The RPAQ was designed to assess usual physical activity in the last month in four domains:

- home (watching television, using a computer, climbing stairs)
- work (type and amount of physical activity)
- commuting to work (by car, public transport, cycling, and/or walking), and
- leisure activities (frequency of participation in 35 different activities (none to every day) and average time per episode)

The RPAQ was given to participants at the food diary pick-up visit and was completed while the interviewer was present.

Detailed descriptions of the assessment of adult and children's physical activity in the NDNS RP and the processing of data from the ActiGraph and RPAQ are available in Appendices G and V, respectively, but a brief description is provided within each section below.

4.3.2 Physical activity in adults

4.3.2.1 Estimation of physical activity

Using the Physical Activity Compendium,²⁴ all activities covered by the RPAQ, including the type and amount of physical activity at work, were grouped into one of four categories representing the metabolic cost of each activity, expressed in metabolic equivalents (METs):

- sedentary (< 2 METs)
- light (2-3.5 METs)
- moderate (3.6-6 METs)
- vigorous (>6 METs)

For each participant, the number of hours per day (h/d) spent in each of the four categories was computed (see Appendix V). Time spent in each moderate or vigorous activity (≥ 3.6 METs) was summed to provide the mean daily time (in h/d) spent in moderate or vigorous activities, the variable used to summarise adult physical activity levels in this report. As the physical activity data were skewed, the median rather than mean number of h/d spent in moderate or vigorous activity is presented as the summary measure of overall activity. The 5th, 10th, 25th, 75th, 90th and 95th percentiles are also shown.

4.3.2.2 Results

Table 4.3 shows median number of h/d spent in moderate or vigorous physical activity by age group and sex.

Median h/d spent in moderate or vigorous physical activities was higher in men (1.0h/d) than in women (0.4h/d). It should be noted that this comparison was not formally tested.

(Table 4.3)

4.3.2.3 Comparisons with other surveys

The median h/d spent in moderate or vigorous physical activities were similar in both the NDNS RP Northern Ireland and NDNS RP UK samples (1.0h/d in both surveys in men and 0.4 and 0.5h/d respectively in women).²⁵

4.3.3 Physical activity in children

4.3.3.1 Measurement of physical activity

Objective measurements of physical activity were taken using the ActiGraph GMT1,²⁶ which recorded vertical movement, where the number of movements ('counts') increase with the intensity of activity. The ActiGraph records different periods during the day spent at different levels of activity, i.e. differing levels of 'counts per minute' (cpm) while the wearer is sedentary or engaging in light, moderate, or vigorous activity.²⁷ For this report, the minimum wear time criterion for inclusion in analysis was set at 24 hours.²⁸ The average daily cpm for each child was calculated as a weighted average based on the probability of wear/non-wear (for a minimum wear time of at least eight hours per day).

As the cpm data were skewed, the median rather than mean daily cpm is presented as the summary measure of overall activity.²⁹ The 5th, 10th, 25th, 75th, 90th and 95th percentiles are also shown.

The results in Table 4.4 characterise the range of activity levels found in boys and girls in the two age groups. Due to the small cell sizes, results should be treated with caution.

4.3.3.2 Results

Table 4.4 shows the average daily volume of physical activity, expressed as median cpm. The median cpm in those aged 4 to 15 years were 532cpm and 415cpm in boys and girls, respectively. It should be noted that these comparisons were not formally tested.

(Table 4.4)

4.3.3.3 Comparisons with other surveys

Both the NDNS RP UK and NDNS RP Northern Ireland samples show, as has been found elsewhere, that boys are more active than girls, and that activity levels fall with age, particularly amongst girls. The median cpm in boys aged 4 to 15 years were 534cpm and 532cpm in the NDNS RP UK and NDNS RP Northern Ireland samples respectively. Equivalent figures in girls aged 4 to 15 years were 452 and 415cpm. These comparisons were not formally tested.

¹ Measurements of mid upper arm circumference (MUAC) are not reported in this chapter but will be included in the archived data (see Appendix Q for more detail).

² <https://www.gov.uk/government/publications/national-diet-and-nutrition-survey-results-from-years-1-to-4-combined-of-the-rolling-programme-for-2008-and-2009-to-2011-and-2012> (accessed 23/09/14).
Bates B, Lennox A, Prentice A, Bates C, Page P, Nicholson S, Swan G. National Diet and Nutrition Survey. Results from Years 1, 2, 3 and 4 (combined) of the Rolling Programme (2008/2009-2011/12). Public Health England; 2014.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/310995/NDNS_Y1_to_4_UK_report.pdf (accessed 17/10/2014)

³ Department of Health, Social Services & Public Safety (2012). Health Survey Northern Ireland: First results from the 2011/12 survey. Department of Health, Social Services & Public Safety: Belfast.
http://www.dhsspsni.gov.uk/health_survey_northern_ireland_-_first_results_from_the_2011-12_survey.pdf (accessed 17/10/2014)

⁴ Demispan is defined as the distance between the mid-point of the sternal notch and the finger roots with the arm outstretched laterally. Using BMI based on demispan equivalent height is recommended where no measured height is available, and has been suggested as a preferred measure of BMI in older people. (Hirani V, Mindell J. *A comparison of measured height and demispan equivalent height in the assessment of body mass index among people aged 65 years and over in England*. Age Ageing. 2008;37:311-7.)

⁵ The demispan equivalent height was calculated using regression equations derived by Bassey: (Bassey EJ. *Demispan as a measure of skeletal size*. Annals of Human Biology 1986; 13: 499-502.)
Females: Height (cm) = (1.35x demispan in cm) + 60.1
Males: Height in (cm) = (1.40x demispan in cm) + 57.8.

⁶ These data are not shown but are included in the archived data.

⁷ All fieldworkers were trained to carefully observe the standard measurement protocols. Each measurement was taken twice. Where the discrepancy between the measurements was at or above a given value (height \geq 0.5cm, weight \geq 0.2kg, waist and hip circumferences \geq 3cm), a third measurement was taken. The mean of the two closest measurements was used. If only one measurement was available, it was excluded from the analysis.

⁸ *World Health Organization Body mass index (BMI) classification*. [On-line]
www.who.int/bmi/index.jsp?introPage=intro_3.html (accessed 11/12/2012).

⁹ National Institute of Health and Clinical Excellence. *Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children*. Dec 2006 [On-line]
www.nice.org.uk/guidance/index.jsp?action=download&o=38295. page 221 (accessed 11/12/2012).

¹⁰ Molarius A, Seidell JC. *Selection of anthropometric indicators for classification of abdominal fatness – a critical review*. Int J Obes 1998; 22: 719-27.

¹¹ The term 'significant' refers to statistical significance (at the 5% level).

¹² SACN/RCPCH. *Application of WHO Growth standards in the UK*. London: TSO, 2007.
www.sacn.gov.uk/pdfs/sacn.rcpch_who_growth_standards_report_final.pdf (accessed 29/03/2012)

¹³ Royal College of Paediatrics and Child Health / World Health Organisation. *The UK WHO Growth Charts: Early Years*. London: RCPCH, 2009. www.rcpch.ac.uk/Research/UK-WHO-Growth-Charts (accessed 21/12/2011).

¹⁴ The new UK-WHO 0-4 years growth charts were introduced in the UK because they represent an international standard of growth for healthy infants and young children. Breastfed infants exhibit a healthier pattern of growth. The new charts were constructed using the WHO Growth Standards for infants aged two weeks to four years, which used data from healthy children from around the world with no known health or environmental constraints to growth. WHO found that infants worldwide have very similar patterns of linear growth, whatever their ethnic origin. The new charts provide a description of optimal growth, describing the ideal patterns of growth for all UK children,

whatever their ethnic origin and however they are fed in infancy. The WHO data is combined with birth data for gestations 23 to 42 weeks from the UK1990 growth reference, as the WHO dataset did not include preterm infants. The UK1990 reference is still to be used for children aged four years and over.

¹⁵ Royal College of Paediatrics and Child Health / World Health Organisation. *The UK WHO Growth Charts: Early Years*. London: RCPCH, 2009. www.rcpch.ac.uk/Research/UK-WHO-Growth-Charts (accessed 21/12/2011).

¹⁶ Cole T, Freeman JV, Preece MA. *Body mass index reference curves for the UK, 1990*. Arch Dis Child 1995; 73: 25-29.

¹⁷ Scientific Advisory Committee on Nutrition and Royal College of Paediatrics and Child Health. *Consideration of issues around the use of BMI centile thresholds for defining underweight, overweight and obesity in children aged 2-18 years in the UK*. April 2012. Online at: http://www.sacn.gov.uk/reports_position_statements/position_statements/sacnrcpch_joint_statement_on_defining_child_underweight_overweight_and_obesity_in_the_uk_-_april_2012.html (accessed 04/07/12)

¹⁸ The age at which a participant is defined as an adult is slightly different between the surveys: in the NDNS RP participants aged 19 years and over are classed as adults whereas for the Health Survey Northern Ireland, those aged 16 years and over are defined as adults. In the results, 'younger' means from that minimum age up to 64 years.

¹⁹ Comparisons are shown between the NDNS RP Northern Ireland and NDNS RP UK samples only as the 2011/12 Health Survey Northern Ireland assessed obesity for children based on the International Obesity Task Force guidelines.

²⁰ Hypertension was defined as at or over 140/90mmHg in the following paper: Williams B, Poulter NR, Brown MJ et al. *Guidelines for management of hypertension: report of the fourth working party of the British Hypertension Society, 2004 –BHS IV*. J Hum Hypertens. 2004; 18:139-85. These thresholds were reiterated in the latest NICE guidelines, which also recommend ambulatory blood pressure monitoring to confirm a diagnosis of hypertension if the clinic measurement indicates blood pressure at or over the 140/90mmHg threshold. <http://publications.nice.org.uk/hypertension-cg127/key-priorities-for-implementation#diagnosing-hypertension>. Within the constraints of the survey, blood pressure was measured three times, and the average of the second and third readings used for analysis.

²¹ A decision was made to exclude blood pressure results for children (from all of the NDNS RP Years 1 to 4 publications) because of the small numbers but also because of the possibility that, as with BMI, elevated blood pressure in children may be age, sex and height-specific and it is not possible to take account of all issues/relevant thresholds.

²² Participants who reported that they were taking medication prescribed for hypertension are classified as either controlled (if their blood pressure falls within the normal range) or uncontrolled (if it is raised).

²³ Besson H, Brage S, Jakes RW, Ekelund E, Wareham NJ. Estimating physical activity energy expenditure, sedentary time and physical activity intensity by self-report in adults. *Am J Clin Nutr*. 2010;91:106-114.

²⁴ Ainsworth BE, Haskell WL, Whitt MC, et al. Compendium of Physical Activities: an update of activity codes and MET intensities. *Med Sci Sport Exer*. 2000;32(suppl):S498-S516.

²⁵ Comparisons are shown between the NDNS RP Northern Ireland and NDNS RP UK samples only. The 2011/12 Health Survey Northern Ireland assessed the proportion of adults meeting previous recommendations of 30 minutes of moderate activity on at least five days a week based on the short version of the International Physical Activity Questionnaire (IPAQ).

Results from the NDNS RP Northern Ireland sample are slightly higher than those reported in the Northern Ireland Sport and Physical Activity Survey 2010: using the arithmetic mean as the summary measure of overall activity, men spent 557 minutes and women 394 minutes per week on activities that raised their breathing rate (1.3 and 0.9 h/d respectively). (Donnelly, P. *The Northern Ireland Adult Sport and Physical Activity Survey 2010*. Belfast: Sport Northern Ireland.)

<http://www.sportni.net/sportni/wp-content/uploads/2013/03/SAPASReport.pdf> (accessed 17/10/2014).

²⁶ The ActiGraph model is a small and lightweight device around the size of a matchbox that is worn on the waist using a belt. A detailed description of the ActiGraph is available in Appendix G.

²⁷ A number of different authors have produced thresholds to distinguish these categories of activity intensity, based on counts per minute (cpm), by asking children to walk or run on a treadmill while wearing an accelerometer, then comparing the cpm data with the known speed of walking/running. However, these equations vary depending on the age of the study participants and other less-well characterised factors.

²⁸ Wear time is an integrated wear probability. It represents the area under the wear probability time-series for each participant and so represents an integral with respect to time. For this report we set the minimum wear time criterion for inclusion in analysis at 24 hours (i.e. at least 8 h/d on at least three days). However, the opportunity for accumulating wear time is somewhat age-dependent.

²⁹ It is possible to convert cpm (counts per minute) levels to METs (metabolic equivalents, as measure of the intensity of activity) and then to physical activity energy expenditure. A number of additional assumptions are required to derive these energy variables, so the decision was made to restrict this chapter to cpm data.

5 Dietary intakes

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Erratum note: Correction to fruit and vegetable consumption estimates including from composite dishes (section 5.3)

In the first publication of this report (in February 2015), consumption estimates for fruit and vegetables, fruit juice and “5-A-Day” portions, including composite dishes, were incorrectly calculated. Fruit and vegetable components of food groups that should have been excluded (see Appendix A of this report) were mistakenly included. These were: soft drinks, confectionery, biscuits, cakes, sugar, preserves (including jam) and sweet spreads, savoury snacks and ice cream. The results presented in this chapter have been updated to correctly exclude all of the food groups that should be excluded as part of the “5-A-Day” calculations. The corrected values for Years 1-4 are therefore slightly lower than the values originally published but the overall conclusions on fruit and vegetable consumption are unchanged. Details of the methodology for estimating fruit and vegetable consumption and calculating “5-A-Day” portions can be found in Appendix A.

5.1 Introduction

The results presented in this chapter derive from the Northern Ireland sample for Years 1 to 4 combined of the NDNS Rolling Programme (NDNS RP). Analysis is based both on Northern Ireland core cases from the UK sample and Northern Ireland boost cases providing an overall Northern Ireland sample of 982 individuals aged 1.5 years and over (see Chapter 2, section 2.8).

Results in this chapter are presented for both sexes combined for the age groups: 1.5 to 3 years, 4 to 10 years, 11 to 18 years, 19 to 64 years and 65 years and over. Results are also subdivided by sex for all age groups, except for children aged 1.5 to 3 years as intakes in this age group do not tend to vary by sex and adults aged 65 years and over because of small numbers.

Unless stated otherwise, all Dietary Reference Values (DRVs) are those presented in the 1991 Committee on Medical Aspects of Food Policy (COMA) report on Dietary Reference Values for Food Energy and Nutrients for the United Kingdom.¹ The comparisons provided in this chapter are observed differences only and have not been tested for statistical significance as the main purpose of this chapter is to describe how the diets of different population age groups compare with recommendations. Caution should be taken when interpreting results where the cell sizes are below 50.

Results are based on dietary assessment using a four-day estimated food diary and represent a daily average of the days assessed.² In Year 1 the study design was to have each participant record both weekend days, in an effort to capture both weekday and weekend consumption for each person. It was thought that the oversampling of weekend days in Year 1 could have led to a bias in reported food consumption and nutrient intake, since it has been shown that there is day-to-day variation in intake of some foods and nutrients for specific age and sex groups. For example, men often consumed alcoholic beverages and takeaway foods more frequently on Fridays and Saturdays, whilst Sunday is often associated with higher consumption of meat and vegetables in many groups (unpublished UK data). Hence the protocol was changed to one where all days of the week would (as far as possible) be equally represented. Year 2 was therefore designed to over-represent weekdays and under-represent weekend days to compensate for the over-representation of weekend days in Year 1 (see section 2.5.1.3). Years 3 and 4 were designed so that all days of the week were evenly represented. However, in the Years 1 to 4 combined data for both the UK sample and the Northern Ireland sample, there remains a slightly higher proportion of Thursdays, Fridays, Saturdays and Sundays than other days (see Table 5A below). This may be explained by the survey design allowing some flexibility in the diary start day to help maintain response rates.

**Table 5A: Number of diary days by day of week (Years 1 to 4 combined)
for UK sample and Northern Ireland only**

Day of the week	All UK		Northern Ireland	
	Number of diary days	% of total days	Number of diary days	% of total days
Monday	3,677	13.5	478	12.3
Tuesday	3,477	12.8	505	13.0
Wednesday	3,382	12.4	509	13.1
Thursday	3,879	14.3	598	15.4
Friday	4,234	15.6	612	15.8
Saturday	4,302	15.8	583	15.1
Sunday	4,232	15.6	586	15.1

Dietary surveys are reliant on self-reported measures of food intake. Misreporting of food consumption, generally underreporting, in self-reported dietary methods is a well-documented issue. The underreporting of energy intake (EI) is known to be an issue in past and current NDNS, as for all dietary surveys and studies.^{3,4} This is an important consideration when interpreting the findings from this survey. Previous NDNS and the current RP are unique amongst large-scale population surveys in their inclusion of doubly labelled water (DLW)⁵ as an objective biomarker to validate EI estimated from reported food consumption.

In the UK NDNS RP, estimates of EI from the four-day diary were compared with measurements of total energy expenditure (TEE) using the DLW technique in a sub-sample of survey participants. The results of this UK analysis indicated that reported EI in adults aged 16 to 64 years was on average 34% lower than TEE measured by the DLW technique, 12% lower in children aged 4 to 10 years, 26% lower in children aged 11 to 15 years, and 29% lower in adults aged 65 years and over. The extent of misreporting of EI has not been estimated separately for Northern Ireland due to the small number of participants from Northern Ireland (17) in the DLW sub-sample.

There are a number of factors that may contribute to this difference including: misreporting of actual consumption; the possibility that participants underreported or changed their usual intake during the diary period which was typically two to three weeks prior to the DLW measurement;

and, methodological considerations relating to dietary assessment method, food composition and portion assignment used in the NDNS RP. It is not possible to extrapolate this estimate of underreporting to individual foods and nutrients because they may be affected differentially.

The energy and nutrient intakes presented in this report have not been adjusted to take account of underreporting.

Appendix X of this report provides a summary of the DLW method, the results of the UK analysis and an illustration of a number of considerations relevant to the interpretation of the survey findings.

An overview of consumption of “marker foods”⁶ and key nutrients is presented with a more detailed age breakdown for young people and adults in Chapter 8, and by equivalised income and Northern Ireland Multiple Deprivation Measure (NIMDM) in Chapter 9. Comparisons between the Northern Ireland sample and the whole of the UK sample of consumption of “marker foods”⁶ and key nutrients are reported in Chapter 10 for standard NDNS age groups.

5.2 Foods consumed

Tables 5.1a-5.1c show mean consumption of standard NDNS food groups for the total Northern Ireland sample (i.e. including non-consumers, those who did not consume from a food group during the four-day diary period). Tables 5.2a-5.2c show mean consumption of standard NDNS food groups for consumers only and the percentage of consumers over four days. Mean consumption levels highlighted in the commentary below are for the total survey population including non-consumers of the food group. Details of the food groups can be found in Appendix R.

(Tables 5.1a-5.2c)

5.2.1 Cereals and cereal products

'White bread' and 'pasta, rice, pizza and other miscellaneous cereals' were the most commonly consumed 'cereals and cereal products', eaten by at least 70% over the four-day diary period, except for those aged 65 years and over, who were less likely to consume 'pasta, rice, pizza and other miscellaneous cereals'. All age groups consumed more bread (all types combined) than 'pasta, rice, pizza and other miscellaneous cereals' with the exception of children aged 1.5 to 3 years who consumed similar quantities of both food types. Mean consumption of 'white bread' exceeded that of all other types combined in all age groups. Children aged 1.5 to 3 years and adults were more likely to consume 'high fibre breakfast cereals' than 'other breakfast cereals'.

'Biscuits' and 'buns, cakes, pastries and fruit pies' were consumed by more than 70% of those aged 4 to 10 years and those aged 65 years and over and by over 50% of all other age groups. 'Biscuits' were also consumed by more than 70% of children aged 1.5 to 3 years.

5.2.2 Milk and milk products

For most age groups, 'semi-skimmed milk' had the highest mean consumption and was the most commonly consumed type of milk. The exception was those aged 1.5 to 3 years for whom 'whole milk' was the most commonly consumed milk. For all age groups, 'cheddar cheese' had the highest mean consumption compared with other types of cheese. Around half of participants in all age groups consumed cheese over the four-day diary period.

5.2.3 Fat spreads

For children, 'reduced fat spread (not polyunsaturated)' was the most commonly consumed fat spread. For adults, 'butter' was the most commonly consumed fat spread.

5.2.4 Meat and meat products

Consumption figures for 'meat and meat products' presented in Tables 5.1a-5.2c include non-meat components of composite and recipe dishes. For children aged 1.5 to 3 years, 'sausages' was the most commonly consumed, with 66% having eaten this type of meat over the four-day diary period. 'Chicken, turkey and dishes' was the most commonly consumed type of meat for children aged 4 to 10 years (72%). 'Bacon and ham' and 'chicken, turkey and dishes' were the most commonly consumed types of meat for children aged 11 to 18 years (71% for both) and adults aged 19 to 64 years (72% for both). For adults aged 65 years and over, the most commonly consumed type of meat was 'bacon and ham', with 74% having eaten this type of meat over the four-day diary period.

Results for disaggregated total meat consumption, excluding non-meat components of meat dishes and products, are presented in Table 5.3 and discussed in section 5.3.

5.2.5 Fish and fish dishes

The highest per cent consumers of 'oily fish' over the four-day recording period were adults aged 65 years and over (30%), followed by adults aged 19 to 64 years (13%) and children aged 1.5 to 3 years (11%). Four percent of children aged 4 to 10 years and 3% of children aged 11 to 18 years consumed 'oily fish' over the four-day diary period. 'White fish coated or fried including fish fingers' was the most commonly consumed type of fish for children aged 10 years and under.

Results for disaggregated total fish consumption, excluding non-fish components of fish products and dishes are presented in Table 5.3 and discussed in section 5.3.

5.2.6 Fruit and vegetables (including potatoes)

This section refers to fruit and vegetables (including potatoes) consumed as discrete items, but excludes those consumed as part of composite dishes such as in meat and in fish dishes. Fruit and vegetable consumption including the contribution from composite dishes and as "5-A-Day" portions are presented in Table 5.3 and discussed in section 5.3.

The highest per cent consumers of 'fruit' over the four-day diary period were children aged 1.5 to 3 years (90%) and children aged 4 to 10 years (89%), followed by adults aged 65 years and over (79%). Children aged 11 to 18 years were the lowest per cent consumers of 'fruit' (63%) over the four-day diary period.

'Vegetables (not raw) including vegetable dishes' were consumed by more than 80% of participants in all age groups. 'Salad and other raw vegetables' were less commonly consumed, particularly by children; no more than 40% of those aged 18 years and under ate this type of food over the four-day diary period.

The highest percentage of consumers of 'chips, fried and roast potatoes and potato products' was in the 4 to 10 years (82%) and 11 to 18 years age groups (86%) and lowest in those aged 65 years and over (60%). 'Other potatoes' (including boiled, mashed and baked, potato salads and dishes) were eaten by more than 70% of all age groups.

5.2.7 Sugar, confectionery and snacks

Mean consumption of 'sugar confectionery' and 'chocolate confectionery' combined was highest in those aged 4 to 10 years and 11 to 18 years (both 21g per day). 'Chocolate confectionery' was consumed by 59% of children aged 1.5 to 3 years, 69% of children aged 4 to 10 years and 57% of children aged 11 to 18 years. 'Sugar confectionery' was less commonly consumed with 34-47% of children eating this type of food over the four-day diary period. Mean consumption of 'sugar confectionery' and 'chocolate confectionery' combined was lowest in those aged 65 years and over (4g per day). However, this age group had the highest mean consumption of 'sugars, including table sugar, preserves and sweet spreads' (14g per day).

5.2.8 Beverages

Children aged 1.5 to 3 years were the highest per cent consumers of 'fruit juice' over the four-day diary period (51%) while adults aged 19 to 64 years were the lowest (30%). Highest mean consumption of 'soft drinks, not low calorie' was seen in children aged 11 to 18 years (258g per day) while highest mean consumption of 'soft drinks, low calorie' was seen in children aged 1.5 to 3 years (235g per day). Children aged 10 years and under consumed more 'soft drinks, low calorie' than 'soft drinks, not low calorie'. Eighty per cent of children aged 11 to 18 years consumed 'soft drinks, not low calorie' over the four-day diary period.

For 'alcoholic beverages' adults aged 19 to 64 years had the highest mean total consumption. For men aged 19 to 64 years, 'beer, lager, cider and perry' was the most commonly consumed, with 40% drinking this type of alcohol over the four-day diary period. For women aged 19 to 64 years, 'wine' was the most commonly consumed, with 29% drinking this type of alcohol over the four-day diary period. As noted in section 5.1, there remains a slightly higher proportion of Thursdays, Fridays, Saturdays and Sundays than other days in the Years 1 to 4 combined data for Northern Ireland (see Table 5A) and this may have some effect on the results for consumption of 'alcoholic beverages'.

5.3 Vegetable, fruit, meat and fish consumption, including from composite dishes

This section reports consumption of vegetables, fruit, meat and fish, including the contribution from composite dishes (both homemade dishes and manufactured products), but excluding the other components of those dishes. All composite dishes in the NDNS Nutrient Databank have been disaggregated into their constituent ingredients so they can be reported separately. Details on the NDNS Nutrient Databank and the methodology for the disaggregation of composite dishes is provided in Appendix A. Mean consumption figures presented in Table 5.3 are for the total population (i.e. including non-consumers, those who did not consume from a food group during the four-day diary period).

Erratum note: correction to fruit and vegetable consumption data

Consumption figures in this section have been corrected for an error in the estimation of fruit, vegetables and fruit juice and the calculation of "5-A-Day" portions. Fruit and vegetable components of some food groups (soft drinks, confectionery, biscuits, cakes, sugar, preserves and sweet spreads, savoury snacks and ice cream) were included in the estimates when they should have been excluded. This has now been corrected and the corrected values are slightly lower than the original published values.

Fruit and vegetable consumption figures in Table 5.3 are based on disaggregated data, and therefore give higher estimates of consumption than Tables 5.1a - 5.1c as they include fruit and vegetables in mixed dishes as well as fruit, salad and cooked vegetables consumed and reported as discrete items.

Mean total vegetable consumption based on disaggregated data was 57g per day for children aged 1.5 to 3 years, 68g per day for children aged 4 to 10 years and 83g per day for children aged 11 to 18 years. For adults, those aged 19 to 64 years consumed a mean of 149g per day and those aged 65 years and over, 142g per day. Mean total fruit consumption was 89g per day for children aged 1.5 to 3 years and those aged 4 to 10 years and 53g per day for children aged 11 to 18 years. Adults aged 19 to 64 years consumed a mean of 79g per day and adults aged 65 years and over, 110g per day. Mean consumption of fruit juice was highest in children aged 4 to 10 years (67g per day) and lowest in those aged 19 to 64 years (35g per day).

The number of portions of fruit and vegetables consumed per day has been calculated from the disaggregated data in line with the “5-A-Day” criteria, including up to one portion each of fruit juice and baked beans or pulses per day (see Appendix A). For children aged 11 to 18 years, mean consumption was 2.3 portions per day.⁷ Adults aged 19 to 64 years consumed 3.3 portions per day, while adults aged 65 years and over consumed 3.6 portions per day. The proportion of participants meeting the “5-A-Day” guideline was 4% of children aged 11 to 18 years, 17% of adults aged 19 to 64 years (14% of men and 20% of women) and 23% of adults aged 65 years and over.

Meat and fish consumption presented in Table 5.3 is based on disaggregated data. These figures give lower estimates of consumption than the figures presented in Tables 5.1a - 5.1c which include the non-meat and non-fish components of composite products and dishes. Mean total meat consumption based on disaggregated data was 121g per day for adults aged 19 to 64 years and 90g per day for adults aged 65 years and over. Mean consumption of red and processed meat was 82g per day for adults aged 19 to 64 years and 69g per day for adults aged 65 years and over. The current recommendation is that, for adults, average intakes of red and processed meat should not exceed 70g per day.⁸

Mean consumption of oily fish was well below the recommendation of at least one portion (140g) per week⁹ in all age groups: for adults aged 19 to 64 years, mean consumption was equivalent to 29g per week and equivalent to 71g per week for adults aged 65 years and over.¹⁰

(Table 5.3, Appendix A)

5.4 Energy and macronutrient intake and percentage contribution of food groups to intake

This section presents daily intakes of energy and macronutrients estimated from the food consumption data, and the percentage contribution of the major food types to intake of each nutrient.

Mean daily intakes of energy and macronutrients are compared with the UK DRVs.^{8,11} For total fat, saturated and *trans* fatty acids and non-milk extrinsic sugars (NMES) the DRVs are the recommended maximum contribution these nutrients should make to the population average diet.¹² For total carbohydrate, *cis*-monounsaturated fatty acids and non-starch polysaccharide (NSP) the DRVs are recommended population averages. For protein, the Reference Nutrient Intakes (RNIs) are set at levels of intake considered likely to be sufficient to meet the requirements of 97.5% of people in the group. For total energy, the DRVs are defined as the Estimated Average Requirements (EARs), that is, the average of energy requirements for any population group and have been taken from the 2011 Scientific Advisory Committee on Nutrition (SACN) report on Dietary Reference Values for Energy.¹¹ Analysis of the percentage contribution of the major food groups to energy and macronutrient intakes shown in Tables 5.5-5.12 uses the traditional NDNS food groups presented in section 5.2 and not the disaggregated food groups presented in section 5.3.

5.4.1 Energy

Mean daily intakes for total energy were 4.78 MJ (1132 kcal) for children aged 1.5 to 3 years, 6.44 MJ (1529 kcal) for children aged 4 to 10 years, 7.40 MJ (1758 kcal) for children aged 11 to 18 years, 8.86 MJ (2108 kcal) for men aged 19 to 64 years, 6.65 MJ (1581 kcal) for women aged 19 to 64 years and 7.21 MJ (1713 kcal) for adults aged 65 years and over. Mean daily intakes for total energy were close to or above the EAR in children aged 10 years and under but below the EAR in other age groups (71% of the EAR in children aged 11 to 18 years, 77% in adults aged 19 to 64 years and 83% in adults aged 65 years and over) (see underreporting in section 5.1).

'Cereals and cereal products' was the largest contributor to energy intake for all age groups, contributing 32-34% of energy intake for children, 30% for adults aged 19 to 64 years and 36% for adults aged 65 years and over. Within this group, 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings' contributed 8% to intake for adults aged 19 to 64 years, 14% for adults aged 65 years and over and 7-11% for children. 'Milk and milk products' was the second largest contributor to energy intake for children aged 1.5 to 3 years (22%) while 'meat and meat products' was the second largest contributor to energy intake for children aged 11 to 18 years (18%) and adults aged 19 to 64 years (19%).

Children aged 4 to 10 years derived a similar proportion of energy from 'milk and milk products' and 'meat and meat products' (15-16%) as did adults aged 65 years and over (12-14%).

(Tables 5.4 and 5.5)

5.4.2 Protein

Mean protein intakes were well above the RNIs in all age/sex groups (table not included) and provided 14.7-15.3% of food energy for children and 17.0-17.1% for adults.

'Meat and meat products' was the largest contributor to protein intake for all age groups except children aged 1.5 to 3 years, with the contribution highest in children aged 11 to 18 years and adults aged 19 to 64 years (both 42%). 'Milk and milk products' was the largest contributor to protein intake for children aged 1.5 to 3 years, providing 32% of intake, with 'meat and meat products' providing 25%. 'Cereal and cereal products' contributed around one quarter of protein intake for all age groups.

(Tables 5.4 and 5.6)

5.4.3 Carbohydrate

The DRV for total carbohydrate is 50% of food energy as a population average. Mean total carbohydrate intakes met the recommendation in children but were slightly below in adults (47.3% food energy in adults aged 19 to 64 years and 48.3% in adults aged 65 years and over).

The largest contributor to carbohydrate intake was 'cereals and cereal products', providing 43-44% for children aged 1.5 to 18 years and adults aged 19 to 64 years and 52% for adults aged 65 years and over. Within this group, 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings' contributed 10% in adults aged 19 to 64 years, 17% in adults aged 65 years and over and 8-13% in children. In addition, 'milk and milk products' contributed 15% of carbohydrate intake for children aged 1.5 to 3 years, 'non-alcoholic beverages' contributed 13% for children aged 11 to 18 years and 'vegetables and potatoes' contributed 15% for adults aged 19 years and over and 10-14% for children.

(Tables 5.4 and 5.7)

5.4.4 Non-milk extrinsic sugars (NMES)

The DRV for non-milk extrinsic sugars (NMES) is that the population average intake should provide no more than 11% of food energy intake in children and adults. Mean intakes of NMES as a percentage of food energy exceeded the DRV in all age groups except those aged 65 years and over (10.5% food energy). Mean intakes were highest for children aged 4 to 10 years (14.6% food energy) and 11 to 18 years (14.3% food energy).

For children, the main sources of NMES were, 'non-alcoholic beverages', 'cereals and cereal products' and 'sugar, preserves and confectionery'. 'Non-alcoholic beverages' contributed 40% to NMES intake for those aged 11 to 18 years and 26-27% for those aged 10 years and under. Within this food group, soft drinks contributed 32% to NMES intake for children aged 11 to 18 years and 14% for children aged 1.5 to 3 years and 17% for children aged 4 to 10 years; 'fruit juice' contributed 8-12% to NMES intake in children across the age groups. 'Cereals and cereal products' contributed 23-29% (of which 13-20% came from 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings') and 'sugar, preserves and confectionery' contributed 23-25% to NMES intake in children across the age groups, 15-18% from confectionery.

For adults aged 19 to 64 years, the main sources of NMES were 'cereals and cereal products' (27%), 'non-alcoholic beverages' (25% - mainly from soft drinks) and 'sugar, preserves and confectionery' (23%). 'Alcoholic beverages' provided a further 9% of intake. 'Cereals and cereal products' was the main contributor to NMES intake for adults aged 65 years and over, providing 40%, mainly from 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings' (33%). 'Sugar, preserves and confectionery' contributed 27% to NMES intake in this age group, mainly from 'sugars, including table sugar, preserves and sweet spreads'.

(Tables 5.4 and 5.8)

5.4.5 Non-starch polysaccharides

Mean intakes of non-starch polysaccharides (NSP) were 7.8g per day for children aged 1.5 to 3 years, 9.9g per day for children aged 4 to 10 years and 11.3g per day for children aged 11 to 18 years. For adults aged 19 years and over, the DRV is set at a population average intake of 18g per day; mean intakes were well below this at 12.9g per day for adults aged 19 to 64 years and 13.3g per day for those aged 65 years and over.

'Cereals and cereal products' was the largest source of NSP for all age groups, contributing 40-42% for children aged 1.5 to 18 years, 38% for adults aged 19 to 64 years and 44% for adults aged 65 years and over. Within this food group, 'wholemeal bread' and 'brown, granary and wheatgerm bread' provided 9% of intake for adults aged 19 to 64 years and 'high fibre breakfast cereals' 7%. 'Vegetables and potatoes' were the second major contributor to NSP. Vegetables contributed 15% to intakes for children aged 1.5 to 3 years, 12% for children aged 4 to 10 years, 11% for children aged 11 to 18 years and 17% for adults aged 19 years and over. Potatoes contributed 19% for children aged 11 to 18 years and 10-15% for the other age groups.

(Tables 5.4 and 5.9)

5.4.6 Total fat

The DRV for total fat is that the population average intake should provide no more than 35% of food energy intake.¹² Mean percentage food energy from total fat met the recommendation in all age/sex groups, except for men aged 19 to 64 years for whom total fat provided 36.5% of food energy.

'Milk and milk products' was the largest contributor to total fat intake for children aged 1.5 to 3 years, providing 29%, 12% of which from 'whole milk'. 'Milk and milk products' also provided 20% of total fat intake for children aged 4 to 10 years, and 21% from 'cereals and cereal products' (of which 13% came from 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings') and 20% from 'meat and meat products'. For children aged 11 to 18 years and adults aged 19 to 64 years, the main sources of total fat intake were 'meat and meat products' (contributing 26%) and 'cereals and cereal products' (contributing 20%, of which 8-10% came from 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings'). Adults aged 65 years and over derived 23% of their total fat intake from 'cereals and cereal products' (15% from 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings'), 19% from 'meat and meat products' and 18% from 'fat spreads' (7% from 'butter').

(Tables 5.4 and 5.10)

5.4.7 Saturated fatty acids

The DRV for saturated fatty acids is that the population average intake should not exceed 11% of food energy intake.¹² Mean intakes of saturated fatty acids exceeded the DRV for all age groups at 13.6% for children aged 4 to 10 years, 12.5% for children aged 11 to 18 years, 13.1% for adults aged 19 to 64 years and 13.9% for adults aged 65 years and over.

'Milk and milk products' was the largest contributor to saturated fatty acids in children aged 1.5 to 3 years and children aged 4 to 10 years, providing 40% and 30% respectively. This food group was also among the main sources of saturated fatty acids for the other age groups, providing 19-24%. 'Cereals and cereal products' contributed 17-22% to intakes across all age groups. 'Biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings' contributed more than half of this for children aged 4 to 10 years and adults aged 65 years and over and around half for the other age groups. 'Meat and meat products' contributed 15% for children aged 1.5 to 3 years, 18% for children aged 4 to 10 years, 25% for children aged 11 to 18 years, 26% for adults aged 19 to 64 years and 18% for adults aged 65 years and over. 'Fat spreads' contributed 18% to saturated fatty acids intake for adults aged 65 years and over (10% from 'butter').

(Tables 5.4 and 5.11)

5.4.8 Trans fatty acids

The DRV for *trans* fatty acids is that the population average intake should provide no more than 2% of food energy.¹² Mean *trans* fatty acid intakes were less than 2g per day for all age groups, representing 0.6-0.8% of food energy, thereby meeting the DRV. Intakes at the upper 2.5 percentile also met the DRV, providing 1.1-1.8% of food energy.

Trans fatty acids are derived from two sources in the diet: those that occur naturally in meat and dairy products of ruminant animals, and those produced artificially through food processing. The levels of *trans* fatty acids from artificial sources have been reduced in recent years. This has resulted in a relative increase in the per cent contribution to intake of *trans* fatty acids derived from natural sources.

'Milk and milk products' was the largest contributor to *trans* fatty acid intake in children aged 1.5 to 3 years (44%) and children aged 4 to 10 years (37%). 'Milk and milk products' was also a key source of *trans* fatty acids for older children and adults, providing 24-28%. The contribution of 'meat and meat products' to *trans* fatty acid intake was 16% in children aged 1.5 to 3 years, 19% in children aged 4 to 10 years, 25% in children aged 11 to 18 years, 27% in adults aged 19 to 64 years and 21% in adults aged 65 years and over. 'Cereals and cereal products' contributed 13-19% to *trans* fatty acid intake across the age groups, of which 'biscuits', 'buns, cakes, pastries and fruit pies' and 'puddings' contributed more than half of this for children aged 4 to 10 years and adults aged 65 years and over and about half for the other age groups.. 'Fat spreads' contributed 15% to *trans* fatty acids intake for adults aged 65 years and over, mainly from 'butter' (10%).

(Tables 5.4 and 5.12)

5.4.9 Unsaturated fatty acids

The DRV for *cis* monounsaturated fatty acids is 13% of food energy as a population average. Mean intakes of *cis*-monounsaturated fatty acids provided 11.5-13.1% of food energy for both children and adults.

Mean intake of *cis* n-3 polyunsaturated fatty acids (PUFA), expressed as a percentage of food energy, increased with age from 0.8% for children aged 10 years and under to 1.0% for adults aged 19 years and over.

Mean intake of *cis* n-6 PUFA expressed as a percentage of food energy, ranged from 4.0% for children aged 1.5 to 3 years to 5.1% for adults aged 19 to 64 years.

(Table 5.4)

5.5 Alcohol

This section reports on alcohol intake in grams per day and as a per cent of total energy, for both the total sample (including non-consumers) and consumers only (those who reported consumption of alcoholic beverages in the four-day food diary).¹³ For the 11 to 18 years and 65 years and over age groups the numbers of consumers were too small to report alcohol intakes for consumers only.

There is a slightly higher proportion of Thursdays, Fridays, Saturdays and Sundays than other days in the Years 1 to 4 combined data for Northern Ireland, and this should be taken into account when interpreting findings on alcohol intake as there is evidence that alcohol consumption is higher on weekend days than week days (see section 5.1 Table 5A).

Fifty per cent of men and 41% of women aged 19 to 64 years consumed alcohol over the four-day diary period. For these consumers, alcohol provided on average 10.7% of energy intake for men and 6.9% for women. For male consumers, alcohol intakes at the upper 2.5 percentile provided 31.5% of energy intake over the four-day diary period.

Questions about alcoholic beverage consumption were also asked in the Computer Assisted Personal Interview (CAPI) interview and via self-completion for children and young adults. This is reported in Section 3.7 in terms of units of alcohol and related to recommended sensible drinking guidelines. The time period recalled in the CAPI/self-completions was the seven days before interview and so does not overlap with the diary recording period.

(Table 5.13)

5.6 Vitamins and minerals and percentage contribution of food groups to micronutrient intakes

Intakes of vitamins and minerals are reported in two ways: from foods only and from all sources, that is, including dietary supplements, as recorded in the four-day food diary. This section also reports on vitamin and mineral intakes from foods only for the group of individuals who recorded taking at least one dietary supplement (regardless of the type) during the four-day diary period compared with intakes for the group who did not record taking any dietary supplements during this period. The percentage of individuals taking supplements and the different types of dietary supplements taken is reported in section 5.7.

For those vitamins and minerals for which UK RNIs and Lower Reference Nutrient Intakes (LRNIs) have been published,⁸ the proportion of participants with intakes below the LRNI is shown and mean daily intakes are compared with the RNI. The RNI for a vitamin or mineral is the amount of the nutrient that is sufficient for 97.5% of people in the group. If the average intake of the group is equal to the RNI, then the risk of deficiency in the group is judged to be very small.

However, if the average intake is lower than the RNI then it is more likely that some of the group will have an intake below their requirement. The adequacy of vitamin or mineral intake can be expressed as the proportion of individuals with intakes below the LRNI. The LRNI for a vitamin or mineral is set at the level of intake considered likely to be sufficient to meet the needs of only 2.5% of the population. As diet is recorded for only four days in the NDNS RP, estimated intake values may not represent intakes over the longer term for micronutrients that are not widely distributed in foods such as vitamin A. It should also be noted that DRVs for some micronutrients such as magnesium, potassium, selenium and zinc are based on very limited data so caution should be used when assessing adequacy of intake using the LRNI. Published UK RNIs and LRNIs are shown in Tables 5.14 and 5.32.

Analysis of the percentage contribution of the major food groups to micronutrient intake as shown in Tables 5.21-5.31 and Tables 5.39-5.47 uses the traditional NDNS food groups presented in section 5.2 and not the disaggregated food groups presented in section 5.3.

(Table 5.14 and 5.32)

5.6.1 Vitamins

5.6.1.1 Vitamin A and retinol

Vitamin A is found in two forms: as retinol in foods from animal sources and as carotenoids (mainly beta-carotene) in foods from plant sources. Some carotenoids can be converted to retinol in the body; 6mg of dietary beta-carotene is considered equivalent to 1mg of retinol. The total vitamin A content of the diet (from both animal and plant sources) is normally expressed as retinol equivalents (RE). Intakes are presented in this report for total vitamin A and pre-formed retinol. Intakes of carotenoids are not presented but are included in the dataset deposited at the UK Data Archive (details can be found in Appendix W).¹⁴ Plasma concentrations of retinol and carotenoids are presented in Chapter 6.

Mean daily intakes of vitamin A from food sources were close to or above the RNI for all age and sex groups except girls aged 11 to 18 years (86% of the RNI). Fourteen per cent of children aged 11 to 18 years (8% of boys, 19% of girls) and 11% of men aged 19 to 64 had intakes from food sources below the LRNI. The inclusion of dietary supplements had little effect on the per cent with intakes below the LRNI.

'Milk and milk products' was the largest contributor of vitamin A for children aged 1.5 to 3 years, providing 32%. 'Milk and milk products' was also a key source of vitamin A intake for children aged 4 to 10 years, providing 24%. Vegetables were the major contributor to vitamin A intake for adults aged 19 to 64 years (28%) and adults aged 65 years and over (31%) of intake. 'Fat spreads' contributed 16-21% to vitamin A intakes across the age groups. 'Meat and meat products' contributed 17% for adults aged 19 to 64 years, less in other age groups.

'Milk and milk products' was the largest contributor to retinol intake for children aged 1.5 to 3 years (50%) and 4 to 10 years (43%). 'Fat spreads' was the second largest contributor providing 26% for children aged 1.5 to 3 years and 28% for children aged 4 to 10 years. For children aged 11 to 18 years and adults aged 19 to 64 years, 'milk and milk products' and 'fat spreads' each provided around a third of retinol intake. Adults aged 65 years and over derived 37% of their intake from 'fat spreads' and 27% from 'milk and milk products'. 'Cereals and cereal products' provided 12-18% of retinol intake across the age groups.

(Table 5.15-5.17a and 5.21-5.22)

5.6.1.2 Thiamin

Mean daily intakes of thiamin from food sources were well above the RNI for all age/sex groups. Less than 0.5% of participants had intakes of thiamin from food sources below the LRNI.

The major source of thiamin for all age groups was 'cereals and cereal products', mainly bread (all types combined) and fortified breakfast cereals. The contribution from 'cereals and cereal products' decreased with age, providing 45% of intake for children aged 1.5 to 3 years and 35-37% for adults aged 19 years and over. For children aged 1.5 to 3 years, 'milk and milk products' was the second largest contributor to thiamin intake (17%) while 'meat and meat products' and 'vegetables and potatoes' were the second largest contributors for the other age groups, the contribution generally increasing with age.

(Table 5.15-5.17a and 5.23)

5.6.1.3 Riboflavin

Mean daily intakes of riboflavin from food sources were above the RNI for all age/sex groups. However, 15% of children aged 11 to 18 years (8% of boys, 21% of girls) and 12% of women aged 19 to 64 years had intakes of riboflavin from food sources below the LRNI. The inclusion of dietary supplements had little effect on the percentages with intakes below the LRNI.

The major contributor to riboflavin intake was 'milk and milk products', providing 53% for children aged 1.5 to 3 years, 45% for children aged 4 to 10 years, 33% for children aged 11 to 18 years, 31% for adults aged 19 to 64 years and 38% for adults aged 65 years and over. 'Cereals and cereal products' were the second largest contributor, providing 28-30% of riboflavin intakes for children and 23% for adults, primarily from fortified breakfast cereals. 'Meat and meat products' contributed an additional 17% to riboflavin intake for children aged 11 to 18 years, 18% for adults aged 19 to 64 years and 7-13% for the other age groups.

(Table 5.15-5.17a and 5.24)

5.6.1.4 Niacin equivalents

Mean daily intakes of niacin equivalents from food sources were well above the RNI for all age/sex groups. Less than 0.5% of participants had intakes of niacin equivalents from food sources below the LRNI.

The main sources of niacin equivalents were 'cereals and cereal products' and 'meat and meat products'. 'Cereals and cereal products' was the largest contributor to niacin intake for children aged 1.5 to 3 years, providing 35%. 'Meat and meat products' was the largest contributor for children aged 4 to 18 years and for adults aged 19 years and over, providing 34-41% of niacin intake.

(Table 5.15-5.17a and 5.25)

5.6.1.5 Vitamin B₆

Mean daily intakes of vitamin B₆ from food sources were well above the RNI for all age/sex groups. Less than 0.5% of participants had intakes of vitamin B₆ from food sources below the LRNI.

The major contributors to vitamin B₆ for children aged 1.5 to 3 years were 'cereals and cereal products' and 'milk and milk products', providing 22-23%. For children aged 4 to 18 years, 'cereals and cereal products' contributed 22-24% of intake, 'vegetables and potatoes' contributed 17-20% and 'meat and meat products' contributed 20-22% to vitamin B₆ intake. For adults, the major contributors were 'meat and meat products' (20-26%), 'vegetables and potatoes' (21-25%) and 'cereals and cereal products' (17-18%).

(Table 5.15-5.17a and 5.26)

5.6.1.6 Vitamin B₁₂

Mean daily intakes of vitamin B₁₂ from food sources were well above the RNI for all age/sex groups. The proportion of individuals with intakes below the LRNI was 5% or less.

'Milk and milk products' was the largest contributor to vitamin B₁₂ intake for all age groups, with the contribution highest for children aged 1.5 to 3 years (63%) decreasing to 35-40% for children aged 11 to 18 years and adults aged 19 years and over. 'Meat and meat products' contributed 24% to intakes for children aged 4 to 10 years and adults aged 65 years and over, 31% for children aged 11 to 18 years and 33% for adults aged 19 to 64 years.

(Table 5.15-5.17a and 5.27)

5.6.1.7 Folate

Mean daily intakes of folate from food sources were close to or above the RNI for all age/sex groups. Seven per cent of girls aged 11 to 18 years had intakes from food sources below the LRNI. The inclusion of dietary supplements had little impact on the percentages with intakes below the LRNI.

'Cereals and cereal products' was the largest contributor to folate intake, providing 36-37% for children aged 1.5 to 18 years and 29% for adults aged 19 years and over. Fortified breakfast cereals provided about half of this for children. 'Vegetables and potatoes' provided 23% for children aged 11 to 18 years and 26% for adults aged 19 years and over. 'Milk and milk products' provided 18% of folate intake for children aged 1.5 to 3 years and 13% for children aged 4 to 10 years. 'Beer, lager, cider and perry' contributed 10% to folate intakes for men aged 19 to 64 years.

(Table 5.15-5.17a and 5.28)

5.6.1.8 Vitamin C

Mean daily intakes of vitamin C from food sources were well above the RNI for all age/sex groups. The proportion of individuals with intakes below the LRNI was 2% or less.

The main source of vitamin C for children was 'non-alcoholic beverages', providing 33-39%, of which 14-16% came from 'fruit juice' and 19-23% from soft drinks. 'Vegetables and potatoes' and 'fruit' were the other main sources. 'Fruit' made a higher contribution to intake in children aged 1.5 to 3 years and 'vegetables and potatoes' in children aged 11 to 18 years.

For adults, the main source of vitamin C was 'vegetables and potatoes', providing 38% for those aged 19 to 64 years and 41% for those aged 65 years and over. 'Non-alcoholic beverages' provided 19% of intake in adults aged 19 to 64 years and 15% in adults aged 65 years and over. 'Fruit' contributed 16% to vitamin C intake for adults aged 19 to 64 years and 22% for adults aged 65 years and over.

(Table 5.15-5.17a and 5.29)

5.6.1.9 Vitamin D

For vitamin D, RNIs are set only for those aged up to four years and those aged 65 years and over. Mean intakes from food sources were well below the RNI in both these age groups: 25% of the RNI for children aged 1.5 to 3 years and 36% for adults aged 65 years and over. Dietary supplements made little difference to mean intake for children aged 1.5 to 3 years. For adults aged 65 years and over, dietary supplements brought the mean intake in this group as a whole (including non-supplement takers) up to 57% of the RNI.

There are no LRNIs set for vitamin D. 'Meat and meat products' was the largest contributor to vitamin D intake for children aged 4 to 10 years, providing 31% of intake, children aged 11 to 18 years (41% of intake) and for adults aged 19 to 64 years (35% of intake). 'Fat spreads', most of which have added vitamin D, contributed 22-28% to intake across the age groups. 'Cereals and cereal products' provided 12-18% of intake across the age groups, from fortified breakfast cereals and from 'buns, cakes, pastries and fruit pies' and 'puddings' (via fats and eggs used as ingredients). The contribution from 'fish and fish dishes' was 10% in adults aged 19 to 64 years and 19% in adults aged 65 years and over, mainly from 'oily fish', a rich source of vitamin D. The contribution of 'oily fish' in children was much lower; 1-4% of total vitamin D intake.

(Table 5.15-5.16a and 5.30)

5.6.1.10 Vitamin E

There are no RNIs or LRNIs set for vitamin E. However, intakes above 4mg per day for men and above 3mg per day for women are considered safe and adequate.⁸ Mean intakes of vitamin E for were well above these levels for men and women aged 19 years and over.

The main sources of vitamin E were 'cereals and cereal products', 'fat spreads' and 'vegetables and potatoes'. 'Cereal and cereal products' contributed 20-23% and 'fat spreads' contributed 12-22% to vitamin E intake across the age groups. 'Vegetables and potatoes' contributed 16-21% to vitamin E intakes for children aged 4 to 18 years and adults aged 19 years and over, and 11% for children aged 1.5 to 3 years. 'Meat and meat products' contributed 14% for children aged 11 to 18 years and adults aged 19 to 64 years.

(Table 5.15-5.15a and 5.31)

5.6.2 Vitamin intakes from food sources for supplement takers versus non-supplement takers¹⁵

Due to small cell sizes, results are presented for sex-combined age groups only. Comparisons are only discussed for those aged 19 to 64 years as the cell sizes for supplement takers in other age groups were below 50. In general, adults in this age group who took supplements during the four-day recording period had similar or higher mean intakes of vitamins from food sources only compared to non-supplement takers. For example, those who took supplements had a mean vitamin C intake of 77.0 mg from food compared to 67.0 mg for those who did not take supplements (15% higher). The percentage of those aged 19 to 64 years with intakes below the LRNI from food sources only was lower or the same in the supplement takers compared to the non-supplement takers. For example, 9% of non-supplement takers had riboflavin intakes from food below the LRNI compared to 2% of supplement takers.

The percentage of individuals taking supplements and the different types of dietary supplements taken is reported in Section 5.7.

(Table 5.18-5.20)

5.6.3 Minerals

5.6.3.1 Iron

Mean daily intakes of iron from food sources were below the RNI for girls aged 11 to 18 years where the mean intake reached only 56% of the RNI and women aged 19 to 64 years where the mean intake was 73% of the RNI. Intakes were also below the RNI for children aged 1.5 to 3 years (89% of the RNI). Dietary supplements made little difference to mean intakes for girls aged 11 to 18 years and children aged 1.5 to 3 years. For women aged 19 to 64 years, dietary supplements made a considerable difference to iron intakes bringing the mean intake of women in this group as a whole (including non-supplement takers) up from 73% to 101% of the RNI, although there was little change to the median intake, suggesting that those with higher intakes from food sources were taking these supplements.

Fifty per cent of girls aged 11 to 18 years and 27% of women aged 19 to 64 years had iron intakes from food sources below the LRNI. Dietary supplements had little impact on these groups in terms of the proportions with intakes below the LRNI.

'Cereals and cereal products' was the largest contributor to iron intake for all age groups, with the contribution decreasing with age from 55-56% for children aged 10 years and under to 40-47% for adults aged 19 years and over. Within this food group, bread and fortified breakfast cereals were the main contributors. Across the age groups 'meat and meat products' contributed 13-23% and 'vegetables and potatoes' contributed 12-16% to iron intake.

(Table 5.33-5.35a and 5.39)

5.6.3.2 Calcium

Mean daily intakes of calcium from food sources were close to or above the RNI for all age groups except girls aged 11 to 18 years (85% of the RNI). Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI.

Sixteen per cent of girls and 7% of boys aged 11 to 18 years had calcium intakes from food sources below the LRNI. Nine per cent of women aged 19 to 64 years also had intakes below the LRNI. The inclusion of supplements had no impact on these groups in terms of the proportions with intakes below the LRNI.

'Milk and milk products' was the largest contributor to calcium intake for all age groups, with the contribution highest for children aged 1.5 to 3 years (56%) decreasing to 37% for children aged 11 to 18 years and adults aged 19 to 64 years. The second largest contributor was 'cereals and cereal products', providing 28-36% of intake across the age groups.

(Table 5.33-5.35a and 5.40)

5.6.3.3 Magnesium

Mean daily intakes of magnesium from food sources were below the RNI for children aged 11 to 18 years (70% of RNI), adults aged 19 to 64 years (84% of RNI) and adults aged 65 and over (79% of RNI). Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI.

Forty-four per cent of children aged 11 to 18 years (26% of boys, 63% of girls), 19% of adults aged 19 to 64 years (23% of men, 14% of women) and 15% of adults aged 65 years and over had magnesium intakes from food sources below the LRNI. Dietary supplements had little impact on the proportion with intakes below the LRNI.

'Cereals and cereal products' was the largest contributor to magnesium intake for all age groups, providing 28-34%. 'Milk and milk products' contributed 25% to magnesium intake for children aged 1.5 to 3 years, 19% for children aged 4 to 10 years and 11-14% for older children and adults. Across the age groups, 'vegetables and potatoes' contributed 12-17% and 'meat and meat products' contributed 9-17% to magnesium intake.

(Table 5.33-5.35a and 5.41)

5.6.3.4 Sodium

Mean daily sodium intakes presented in this chapter underestimate total sodium intake from the diet as they include only sodium present in food and do not include additional salt added in cooking or at the table by survey participants. More complete estimates of total sodium intake from the diet are derived from urinary sodium excretion data and are presented in Chapter 7.

For children and adults aged 65 years and over, 'cereals and cereal products' was the largest contributor to sodium intake from food, providing 35% for children and 41% for older adults, of which 16-23% came from bread (all types combined). 'Meat and meat products' was the second largest contributor, providing 23-30% for children across the age groups and 22% for older adults. For adults aged 19 to 64 years, 'cereals and cereal products' and 'meat and meat products' both provided 31% of sodium intake. 'Milk and milk products' contributed 15% for children aged 1.5 to 3 years and 7-11% for the other age groups.

(Table 5.42)

5.6.3.5 Potassium

Mean daily intakes of potassium from food sources were below the RNI for children aged 11 to 18 years (71% of RNI), adults aged 19 to 64 years (76% of RNI) and adults aged 65 years and over (77% of RNI). Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI.

Twenty-four per cent of children aged 11 to 18 years (12% of boys, 36% of girls), 19% of adults aged 19 to 64 years (13% of men, 24% of women) and 15% of adults aged 65 years and over had potassium intakes from food sources below the LRNI. Dietary supplements had no impact on the proportions with intakes below the LRNI.

'Milk and milk products' was the major contributor to potassium intake for children aged 1.5 to 3 years and children aged 4 to 10 years, providing 30% and 23% of intake respectively.

'Vegetables and potatoes' was the largest contributor to potassium intake for children aged 11 to 18 years and adults aged 19 years and over, providing 24-26%. 'Meat and meat products' provided a further fifth of intake in children aged 11 to 18 years and adults aged 19 to 64 years. Across the age groups, 'cereals and cereal products' contributed 15-18%. 'Fruit' provided 12% of potassium intake for children aged 1.5 to 3 years.

(Table 5.33-5.35a and 5.43)

5.6.3.6 Zinc

Mean daily intakes of zinc from food sources were close to or above the RNI for all age/sex groups except girls aged 4 to 10 years (90% of the RNI) and children aged 11 to 18 years (90% and 82% of the RNI for boys and girls respectively). Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI for children aged 11 to 18 years.

Sixteen per cent of children aged 11 to 18 years (10% of boys, 23% of girls) and 8% of boys and girls aged 4 to 10 years had zinc intakes from food sources below the LRNI. Dietary supplements had little impact on the proportion with intakes below the LRNI.

'Meat and meat products' was the largest contributor to zinc intake for adults and children aged 4 to 18 years, providing 32-39%. 'Milk and milk products' was the major contributor to zinc intake for children aged 1.5 to 3 years, providing 32%. 'Cereal and cereal products' contributed 24-27% to zinc intake across the age groups.

(Table 5.33-5.35a and 5.44)

5.6.3.7 Copper

Mean daily intakes of copper from food sources were below the RNI for girls aged 11 to 18 years (85% of the RNI), women aged 19 to 64 years (77% of the RNI) and adults aged 65 years and over (77% of the RNI). Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI. There are no LRNIs set for copper.

'Cereals and cereal products' was the largest contributor to copper intake for all age groups, providing 33-43%. 'Vegetables and potatoes' contributed 12-17% and 'meat and meat products' contributed 13-18% of copper intake.

(Table 5.33-5.34a and 5.45)

5.6.3.8 Selenium

Mean daily intakes of selenium from food sources were below the RNI for children aged 11 to 18 years (77% and 65% of the RNI for boys and girls respectively), adults aged 19 to 64 years (64% of RNI) and adults aged 65 years and over (66% of RNI). Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI.

Thirty-nine per cent of children aged 11 to 18 years (27% of boys, 52% of girls), 50% of adults aged 19 to 64 years (40% of men, 60% of women) and 51% of adults aged 65 years and over had selenium intakes from food sources below the LRNI. Dietary supplements had little impact on the proportions with intakes below the LRNI.

The main sources of selenium were 'cereals and cereal products' and 'meat and meat products'. 'Cereal and cereal products' contributed 26-33% and 'meat and meat products' contributed 23-38% to intake across the age groups. 'Fish and fish products' contributed 21% to selenium intakes for adults aged 65 years and over and less for the other age groups (8-12%). Children aged 1.5 to 3 years derived 18% of their selenium intake from 'milk and milk products'.

(Table 5.33-5.35a and 5.46)

5.6.3.9 Iodine

Mean daily intakes of iodine from food sources were above the RNI for all age/sex groups except girls aged 11 to 18 years (78% of RNI). The inclusion of intakes from dietary supplements had no impact on mean intakes as a percentage of the RNI.

Nineteen per cent of children aged 11 to 18 years (13% of boys, 26% of girls) had iodine intakes from food sources below the LRNI. Eleven per cent of women aged 19 to 64 years also had intakes below the LRNI. Dietary supplements had no impact on the proportions with intakes below the LRNI for these groups.

'Milk and milk products' was the largest contributor to iodine intake for all age groups, with the contribution highest for children aged 1.5 to 3 years (63%) decreasing to 37-42% for children aged 11 to 18 years and adults aged 19 years and over. Across the age groups, 'cereals and cereal products' provided 11-15% of iodine intake. Adults aged 65 years and over derived 13% of their iodine intake from 'fish and fish dishes'.

(Table 5.33-5.35a and 5.47)

5.6.4 Mineral intakes from food sources for supplement takers versus non-supplement takers¹⁵

Due to small cell sizes, results are presented for sex-combined age groups only. Comparisons are only discussed for those aged 19 to 64 years as cell sizes for supplement takers in other age groups are below 50. Adults in this age group who took supplements during the four-day recording period had higher mean intakes of minerals from food sources only compared to non-supplement takers. The percentage of those with mineral intakes from food sources below the LRNI was generally higher in the non-supplement takers. For example, 22% of non-supplement takers had magnesium intakes from food below the LRNI compared to 9% of supplement takers.

The percentage of individuals taking supplements and the different types of dietary supplements taken is reported in Section 5.7.

(Table 5.36-5.38)

5.7 Dietary supplements

Information on consumption of dietary supplements was collected both in the four-day food diary and in the CAPI interview, which asks about consumption in the year before interview. Dietary supplements were defined for participants as products intended to provide additional nutrients or give health benefits and taken in liquid, powder, tablet or capsule form. In the CAPI, participants were asked to list any dietary supplements taken over the past year. In the diary, participants were asked to write down the details of the supplements they took on each diary recording day.

Twenty-four per cent of adults aged 19 to 64 years (17% of men, 31% of women) and 40% of adults aged 65 years and over had taken at least one supplement during the four-day diary period. For children, supplement consumption was most common among children aged 4 to 10 years with 19% taking at least one supplement during the four-day diary period.

In general, a higher proportion of participants reported in the CAPI having taken at least one supplement during the previous year than reported taking a supplement during the four-day diary period.¹⁶ This may be because of infrequent, intermittent or seasonal use of supplements which may not have been captured in the diary period.

For most age groups, the two most common types of supplements were fish oils (including cod liver oil) and multivitamins with or without minerals. Twenty-four per cent of adults aged 65 years and over took 'cod liver oil and other fish oils' during the four-day diary period.

(Tables 5.48 and 5.49)

5.8 Summary

The findings presented in this chapter show that fruit and vegetable consumption was below recommendations in all relevant age groups. Adults aged 65 years and over were more likely than other age groups to meet the "5-A-Day" guideline and to also meet the recommendation to limit red meat consumption. This age group also had the highest consumption of oily fish, although this still fell below the recommended one portion per week.

Recommendations for total fat were met or very close to being met for all age groups. Recommendations for *trans* fatty acids were met in all age groups. However, intakes of saturated fatty acids were in excess of the recommended level for all age groups and, NMES intakes also exceeded the recommended level in all age groups apart from adults aged 65 years and over,

There was evidence for some age groups of low intakes for vitamin A, riboflavin, folate and most minerals, although it is important to take into account that the recording period was four days and this may have been an insufficient period to fully capture intakes of micronutrients that are found in a limited number of infrequently consumed foods.

The findings also indicate that some age groups are consistently not meeting dietary recommendations. Children aged 11 to 18 years in particular consumed the fewest portions of fruit and vegetables, had among the highest percentage of food energy from NMES and had substantial proportions falling below the LRNI for some vitamins and most minerals.

¹ Report on Health and Social Subjects 41 *Dietary Reference Values (DRVs) for Food Energy and Nutrients for the UK*, Report of the Panel on DRVs of the Committee on Medical Aspects of Food Policy (COMA) 1991. The Stationery Office. London

² Participants with dietary data for at least three days were included in the analyses (13 of the 982 participants had only three and not four days of dietary data).

³ Black, AE, Prentice, AM, Goldberg, GR, Jebb, SA, Bingham, SA, Livingstone, MB, Coward, WA, (1993). Measurements of total energy expenditure provide insights into the validity of dietary measurements of energy intake. *J Am Diet Assoc*, 93, 572-9.

⁴ Livingstone, M. B., Black, A. E. (2003). Markers of the validity of reported energy intake. *J Nutr*, 133 Suppl 3, 895S-920S.

⁵ The doubly labelled water technique (DLW) is widely agreed to be the most accurate way of assessing energy expenditure over one to two weeks. Participants in DLW studies drink a weighed amount of water labelled with known amounts of the stable isotopes of hydrogen (²H) and oxygen (¹⁸O₂) based on their body weight. Loss of the two isotopes from body water is assessed by measurement of the rate of decline in concentration of the isotope in samples of the subject's urine, collected during the study period, and measured by isotope ratio mass spectrometry. The difference between the elimination rates of the two isotopes reflects the rate at which CO₂ is produced from metabolism. Energy expenditure can then be estimated from the CO₂ production.

⁶ In order to reduce population energy intake, as part of the Obesity Prevention Strategy for Northern Ireland, "marker foods" (fruit and vegetables; sugary, fizzy drinks and squashes; confectionery; chips and other fried foods; and meat products) have been identified to monitor food categories which are of public health interest.

⁷ "5-a-day" portions of fruit and vegetables were not calculated for children aged 10 years and younger as the 80g portion is only appropriate for older children and adults (see Appendix A).

⁸ Scientific Advisory Committee on Nutrition. Iron and Health. London: TSO, 2010

⁹ Scientific Advisory Committee on Nutrition. Advice on fish consumption: benefits and risks. London: TSO, 2004

¹⁰ Weekly equivalent oily fish consumption has been calculated using unrounded data rather than the rounded figures in Table 5.3.

¹¹ Scientific Advisory Committee on Nutrition. Dietary Recommendations for Energy: [Online]. Available

http://www.sacn.gov.uk/pdfs/sacn_dietary_reference_values_for_energy.pdf (2011) (accessed 03/03/14).

¹² For total fat, saturated and *trans* fatty acids, this recommendation applies to adults and children from the age of five years.

¹³ Consumers also include those who consumed alcohol in recipes and other foods.

¹⁴ <http://www.data-archive.ac.uk> (accessed 03/03/14).

¹⁵ Separate descriptive statistics were carried out on two datasets – one containing all participants who had taken at least one dietary supplement (regardless of the type) during the four-day recording period (the supplement takers) and one containing all participants who had not taken any dietary supplement during the four-day recording period (the non-supplement takers).

¹⁶ For participants aged 1.5 to 3 years, eight reported taking supplements during the recording period and six reported taking supplements in the previous year. For participants aged 65 years and over, 30 reported taking supplements during the recording period and 26 reported taking supplements in the previous year.

6 Blood analytes

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6.1 Introduction

This chapter reports the results of the analysis of blood samples taken during the nurse visit from participants aged 11 years and over in Northern Ireland.¹ Samples were collected between February 2008 and July 2012; Years 1 to 4 of the NDNS RP. In Year 1 there was a two week time lag between the start of the interviewer and nurse stages. From Year 2 onwards, the gap was extended, to an average of eight weeks, with the aim of increasing nurse stage response rates.

The analytes presented in this chapter have been divided into the following main groups:

- Haemoglobin and ferritin
- water-soluble vitamins
- fat-soluble vitamins and carotenoids
- blood lipids
- zinc and selenium

Serum and red cell folate were also measured but results were delayed due to a problem with the laboratory analysis. This has now been resolved and results will be published in March 2015.

The results in Chapter 5 of this report are based on assessment of food consumption over four days and indicate reported dietary intake over a short period. Analysis of blood samples provides an indication of the nutritional status of the population usually over a longer period; that is, the level of nutrients available to the body (after absorption) for use in metabolic processes. For some micronutrients, status can be assessed by directly measuring the concentration of the nutrient in blood, while for others it is assessed by a functional measure such as the degree of activation of vitamin-dependent enzymes.

An overview of the purpose, methodologies and other procedures associated with obtaining blood samples from participants are provided in Chapter 2 and Appendices N to P. Examples of the letters sent to a participant and/or their GP containing results for clinically reportable analytes measured in their blood sample are presented in Appendix L. Analytes were given a priority order for analysis according to their clinical and public health importance (see Appendix N). Appendix O details the procedures for obtaining written consent from adult participants and the parent/legal guardian of child participants, including written child assent where appropriate, prior to blood sampling. Appendix J contains examples of consent forms used in the NDNS RP. Appendix O also provides information about obtaining and processing blood samples, the recruitment of field laboratories and the transport and storage of blood samples. Appendix P details the quality control data and methodology of blood analysis for each analyte described in this report. The nurse (stage two) participant information documents are provided in Appendix H. Appendix W lists the analytes included in this report and details of other analytes which have been measured and will be included in the Years 1 to 4 dataset deposited at the UK Data Archive.²

6.1.1 Obtaining the blood sample

Blood samples were requested from all fully productive participants³ aged 1.5 years and over who were visited by a nurse (735 individuals)¹ where informed consent was obtained. Appropriate consents were obtained, including for children under 16 years of age, written parental consent, along with written assent from the child where the child was able to provide. Blood samples were collected by venepuncture by a qualified nurse or paediatric phlebotomist using a Sarstedt fixed or butterfly needle, depending on the blood taker's preference. The monovette tube system was used as it is a closed system, and allows the safe collection of blood in a participant's home. Children aged 4 to 15 years¹ where parental consent was obtained, were offered application of anaesthetic gel prior to venepuncture. In accordance with external ethical approval (see Chapter 2, section 2.3 for more information regarding ethical approval) and participant consent, a maximum of 10.9mL of blood was taken from participants aged 1.5 to 6 years,¹ a maximum of 21.1mL from participants aged 7 to 15 years¹ and 35.1mL from participants aged 16 years and over.

Blood was collected in between four and eight tubes, depending on the age group of the participant. Each tube contained anticoagulant/stabilising agent as appropriate for the analysis required.

The following monovette tubes were filled according to age of the participant:

<u>Age group</u>	<u>Tubes</u>
1.5 to 6 years ¹	1 x EDTA, 1 x lithium heparin, 1 x serum gel and 1 x serum
7 to 15 years ¹	1 x EDTA, 1 x trace mineral controlled lithium heparin, 1 x lithium heparin, 1 x serum gel, 1 x serum and 1 x fluoride
16 years and over	2 x EDTA, 2 x trace mineral controlled lithium heparin, 1 x lithium heparin, 1 x serum gel, 1 x serum and 1 x fluoride

6.1.2 Blood Response

Of those completing at least three diary days, 20% of children (3% of children aged 4 to 10 years and 41% of children aged 11 to 18 years)¹ and 56% of adults aged 19 years and over provided a blood sample. No blood samples were obtained from children aged 1.5 to 3 years.¹

Blood samples were obtained from a total of 365 fully productive participants aged four years and over. This report presents analytical results for up to 96 children aged 11 to 18 years and 264 adults aged 19 years and over. The numbers in each age group vary slightly for each analyte because, when the quantity of blood collected was not sufficient, lower priority analytes could not be assayed for some individuals. The primary reasons for not obtaining a sample, when consent had been given, were not being able to find a suitable vein or a vein collapsing during the procedure. Further details are provided in Chapter 2 and Appendix O of this report.

6.1.3 Fasting blood samples

Participants aged four years and over were asked to provide an overnight (minimum of eight hours) fasting blood sample. Participants with diabetes who were not willing or not able to fast and those aged 1.5 to 3 years¹ were invited to provide a non-fasting blood sample. The requirement for blood processing to commence within two hours of collection (and also procedure-standardisation) dictated that all samples had to be collected as early in the day as possible, and always before midday.

6.1.4 Transport and storage of blood samples

Following venepuncture, an EDTA and a serum gel monovette tube from each participant's sample set were sent by post, to the Immunology and Biochemistry Laboratory at Addenbrooke's Hospital in Cambridge (Addenbrooke's) for prompt analysis. The remaining blood monovette tubes from a participant's sample set were taken to a local field laboratory for immediate processing and storage below -40°C (or at a maximum of -20°C where -40°C facilities were not available). At the end of each fieldwork period, samples were transported on dry ice to the Medical Research Council Human Nutrition Research (MRC HNR) where they were stored at -80°C before analysis. Appendix O provides further details on the transport, tracking and storage of blood samples.

6.1.5 Analysis of the blood samples

Blood analytes were assigned a priority order based on clinical and policy relevance. Where it was not possible to obtain the full volume of blood from a participant analytes were assayed in the order of priority detailed in Tables N.1, N.2 and N.3 (Appendix N). Therefore the base numbers in the tables may be smaller for the lower priority analytes in each monovette tube than for the higher priority ones.

In addition to the blood analytes presented in Tables 6.1 to 6.5, a selected number of additional analytes are presented in Appendix Q. Data for analytes measured in NDNS RP including those reported in this chapter and Appendix Q will be included in the dataset submitted to the UK Data Archive.²

Appendix P provides details on the quality control measures for all of the assays performed on blood samples in the NDNS RP. All the laboratories performing blood analyses for NDNS RP participate in external quality assessment schemes, where available.

Data for the blood analytes in Tables 6.1 to 6.5 have been weighted to account for differential non-response to providing a blood sample, in order to adjust for any bias arising from blood sampling refusals and/or failures. Details of the methodology used to weight the data are provided in Chapter 2 and Appendix B of this report. Notional values were assigned to results below the limit of detection. These were calculated by dividing the analytical limit of detection by the square root of two.

This method is consistent with that used in the National Health and Nutrition Examination Survey (NHANES) and has been described by Hornung and Reed (1990).⁴ Results are presented for the age groups 11 to 18 years, 19 to 64 years and 65 years and over and are split by sex, except data for the age group 65 years and over which are presented as sex combined only due to limited numbers.

Only limited comparisons have been made with blood analytes data from the UK NDNS RP Years 1 to 4 report due to limited numbers for all age/sex groups in the Northern Ireland dataset.⁵ These are descriptive comparisons only, and are presented in section 6.8 of this chapter.

Cell sizes for boys aged 11 to 18 years, girls aged 11 to 18 years and those aged 65 years and over are small and this should be borne in mind when interpreting the results for these groups. Where accepted thresholds exist to indicate low status for a nutrient or an increased risk of poor function or ill health, the percentage of participants in that category has been provided in Tables 6.1 to 6.5.

6.2 Haemoglobin and ferritin

6.2.1 Haemoglobin concentration (grams/litre, g/L)

Haemoglobin is the iron-containing, oxygen-carrying molecule in red blood cells. Circulating levels of haemoglobin are indicative of the oxygen-carrying capacity of the blood and a low haemoglobin concentration (anaemia) when coupled with low serum ferritin can indicate iron deficiency. Table 6A shows the lower limits for haemoglobin below which anaemia is indicated for those aged 1.5 years and over. The lower limits were set by the World Health Organization (WHO)⁶ and are endorsed by the UK Scientific Advisory Committee on Nutrition (SACN).⁷

Table 6A: Lower limits set by WHO and endorsed by SACN for haemoglobin levels below which anaemia is indicated

Age group	Lower limit for haemoglobin (g/L)
Children aged 1.5 to 4 years	110
Children aged 5 to 11 years	115
Children aged 12 to 14 years	120
Non-pregnant females aged 15 years and over	120
Males aged 15 years and over	130

The mean haemoglobin concentration for each age/sex group was above the relevant lower limit.

The mean haemoglobin concentration for boys aged 11 to 18 years was 139g/L and for girls aged 11 to 18 years it was 133g/L.

The mean haemoglobin concentration for men aged 19 to 64 years was 150g/L, 133g/L for women aged 19 to 64 years and 137g/L for those aged 65 years and over.

The proportion of children with a haemoglobin concentration below the lower limits was 2.2% for girls aged 11 to 18 years. There were no cases below the lower limits in this dataset for boys aged 11 to 18 years.

The proportion of adults with a haemoglobin concentration below the lower limit was 2.4% for men aged 19 to 64 years, 8.8% for women aged 19 to 64 years and 14.2% for those aged 65 years and over.

(Table 6.1)

6.2.2 Plasma ferritin (micrograms/litre, $\mu\text{g/L}$)

Ferritin is an intracellular protein which stores iron. Plasma ferritin concentration gives an indication of the level of iron stores. However, ferritin is an acute phase reactant that is raised in response to infection or inflammation. Therefore a plasma ferritin concentration should be interpreted with care as it can be raised by recent infections or inflammatory conditions, liver disease and other chronic disorders.⁷

The lower limit for plasma ferritin concentration, below which iron stores are considered to be depleted and the risk of iron-deficiency anaemia increased, is 15µg/L for the age groups presented in this chapter.^{6,7}

The mean ferritin concentration for all age/sex groups was above the lower limit of age-appropriate normal range.

The mean plasma ferritin concentration for boys aged 11 to 18 years was 51µg/L and 29µg/L for girls aged 11 to 18 years.

The mean plasma ferritin concentration for men aged 19 to 64 years was 135µg/L, 67µg/L for women aged 19 to 64 years and 95µg/L for those aged 65 years and over.

The proportion of children with a ferritin concentration below the lower limit of the normal range was 5.2% for boys aged 11 to 18 years and 16.9% for girls aged 11 to 18 years.

The proportion of adults with a ferritin concentration below the lower limit of the normal range was 13.7% for women aged 19 to 64 years and 5.7% for those aged 65 years and over. There were no cases of men aged 19 to 64 years below the lower threshold.

(Table 6.1)

6.2.3 Combined index: Haemoglobin concentration (grams/litre, g/L) and plasma ferritin (micrograms/litre, µg/L)

Assessment of an individual's iron status depends on the measurement, interpretation and synthesis of various markers of iron status. Determining adequate iron status is dependent on the measure of more than one marker.⁷ The combination of haemoglobin and ferritin concentrations can be used as a measure of iron status and/or deficiency.

There were no cases of boys nor girls aged 11 to 18 years with a haemoglobin concentration and a plasma ferritin concentration below which iron deficiency is indicated.

The proportion of adults with a haemoglobin concentration and plasma ferritin concentration below which iron deficiency is indicated was 4.2% for women aged 19 to 64 years and 2.0% for those aged 65 years and over. There were no cases of men aged 19 to 64 years below the threshold.

Table Q.1 presents descriptive statistics for plasma soluble transferrin receptors (sTfr).

(Table 6.1)

6.3 Water-soluble vitamins

6.3.1 Plasma vitamin C (micromoles/litre, $\mu\text{mol/L}$)

Vitamin C is needed for the maintenance of healthy connective tissue in the body and it can act as an antioxidant, protecting cells from the damage caused by oxidative free radicals. Clinical deficiency results in scurvy. Plasma vitamin C concentration reflects recent dietary intake of vitamin C; a value of less than $11\mu\text{mol/l}$ indicates biochemical depletion.⁸

The mean concentration for each age/sex group was above the level indicative of biochemical depletion for vitamin C. The mean plasma vitamin C concentration was $62.1\mu\text{mol/L}$ for boys aged 11 to 18 years and $56.6\mu\text{mol/L}$ for girls aged 11 to 18 years.

The mean plasma vitamin C concentration for men aged 19 to 64 years was $44.3\mu\text{mol/L}$, $50.6\mu\text{mol/L}$ for women aged 19 to 64 years and $49.0\mu\text{mol/L}$ for those aged 65 years and over.

There were no cases of children aged 11 to 18 years with a vitamin C concentration below the level indicative of biochemical depletion.

The proportion of adults who had a vitamin C concentration below the level indicative of biochemical depletion was 0.4% for men aged 19 to 64 years and 0.5% for women aged 19 to 64 years. There were no cases below the lower threshold for those aged 65 years and over.

(Table 6.2)

6.3.2 Serum vitamin B₁₂ (picomoles/litre, pmol/L)

Vitamin B₁₂ is a water-soluble vitamin with a key role in normal functioning of the brain and nervous system and in blood cell formation. Serum concentration of vitamin B₁₂ is the commonly used measure of vitamin B₁₂ status.

Vitamin B₁₂ is required, along with folate, for methyl group transfer during protein metabolism, DNA synthesis and the methylation of DNA and various other substrates. The most common cause of vitamin B₁₂ deficiency is failure of the parietal cells of the stomach to secrete Intrinsic Factor (a protein cofactor), leading to impaired absorption and hence pernicious anaemia.⁹ The lower threshold of the normal range for serum vitamin B₁₂ concentration for all ages is usually accepted as 150pmol/L.¹⁰

The mean serum vitamin B₁₂ concentration was 322pmol/L for boys aged 11 to 18 years and 301pmol/L for girls aged 11 to 18 years.

The mean serum vitamin B₁₂ concentration for men aged 19 to 64 years was 271pmol/L, 255pmol/L for women aged 19 to 64 years and 313pmol/L for those aged 65 years and over. Thus, the mean concentration for each age/sex group was above the lower threshold of the normal range of 150pmol/L.

In the 11 to 18 years age group 3.8% of girls had a vitamin B₁₂ concentration below the lower threshold of the normal range.¹⁰ There were no cases below the threshold for boys aged 11 to 18 years.

The proportion of adults who had a vitamin B₁₂ concentration below the lower threshold of the normal range of 150pmol/L was 5.2% for men aged 19 to 64 years, 8.2% for women aged 19 to 64 years and 1.2% for those aged 65 years and over.

(Table 6.2)

6.3.3 Erythrocyte Transketolase Activation Coefficient (ETKAC) for thiamin status (ratio)

Thiamin (vitamin B₁) status is measured by ETKAC. Thiamin is required mainly during the metabolism of carbohydrate, fat and alcohol. Diets high in carbohydrate require higher intake of thiamin than diets high in fat.⁹ As with most water-soluble vitamins, there is no recognised store of non-functional thiamin in the body and the only reserve is that which is functionally bound to enzymes within the tissues. ETKAC is a measure of the reactivation of the cofactor-depleted red cell enzyme transketolase *in vitro* by the cofactor, thiamin diphosphate. The higher the ETKAC, the lower the saturation *in vitro*, and hence the greater the degree of deficiency *in vivo*. This index is sensitive to the lower to moderate range of intakes of thiamin. For adults aged 19 to 64 years, values above 1.25 are indicative of biochemical thiamin deficiency.¹¹

The mean ETKAC in children was 1.11 for boys aged 11 to 18 years and for girls aged 11 to 18 years. In adults mean values were 1.11 for those aged 19 to 64 years (with no difference between men and women) and 1.09 for those aged 65 years and over.

No more than 0.5% of any age/sex group had ETKAC above 1.25, the threshold for adults aged 19 to 64 years.

(Table 6.2)

6.3.4 Erythrocyte Glutathione Reductase Activation Coefficient (EGRAC) for riboflavin status (ratio)

EGRAC is a measure of red cell enzyme saturation with its cofactor flavin adenine dinucleotide (FAD) derived from riboflavin (vitamin B₂). Riboflavin is needed for the utilisation of energy from food and is a cofactor in the metabolism of other B vitamins. It may also be important for the metabolism of iron. The coefficient is expressed as the ratio of two activity measures of the enzyme glutathione reductase, with and without added FAD *in vitro*. The higher the EGRAC, the lower the saturation *in vitro*, and hence the greater the degree of deficiency *in vivo*. A coefficient between 1.0 and 1.3 has generally been considered to be normal.¹² The test is most sensitive at low levels of riboflavin intake. The EGRAC index is highly sensitive to small degrees of cofactor desaturation and raised values are indicative of low vitamin B₂ status. Although moderately raised values are not consistently associated with known functional abnormality, high values indicative of riboflavin deficiency may be associated with compromised iron metabolism.¹³

However, recent research has indicated that the 1.30 threshold may be set too low, so giving an overestimate of the prevalence of functionally-significant low riboflavin status. It has been recommended that the EGRAC threshold should be raised to a level above 1.30 to better recognise riboflavin inadequacy; this requires further consideration.¹² The values at the 75th and 90th percentiles for EGRAC have been provided in Table 6.2 as an additional means of monitoring changes in the population.

All age/sex groups had mean EGRAC greater than 1.30, the generally accepted upper threshold for normal riboflavin (vitamin B₂) status.

The mean EGRAC was 1.48 for boys aged 11 to 18 years and 1.57 for girls aged 11 to 18 years.

The mean EGRAC was 1.39 for men aged 19 to 64 years, 1.49 for women aged 19 to 64 years and 1.30 for those aged 65 years and over.

The highest proportion of individuals with EGRAC above the 1.30 threshold potentially indicating poorer vitamin B₂ status,¹² was in boys aged 11 to 18 years and girls aged 11 to 18 years (73.3% and 96.4% respectively). The proportion of adults aged 65 years and over with EGRAC greater than 1.30 (38.4%) was lower than the proportion of adults aged 19 to 64 years with EGRAC above this threshold (66.2% of men and 71.2% of women).

The values at the 75th percentile ranged from 1.35 for those aged 65 years and over to 1.72 for girls aged 11 to 18 years. The values at the 90th percentile ranged from 1.47 for those aged 65 years and over to 1.81 for girls aged 11 to 18 years and women aged 19 to 64 years.

(Table 6.2)

6.3.5 Plasma pyridoxal-5-phosphate (PLP) (nanomoles/litre, nmol/L)

Vitamin B₆ comprises pyridoxal, pyridoxine, pyridoxamine and their 5'-phosphates, which are metabolically interconvertible. Pyridoxal-5-phosphate (PLP) is the primary biologically active form of vitamin B₆, serving as a co-enzyme for a large number of enzymes which catalyse reactions of amino acids. These are important in the body's overall protein metabolism and B₆ requirements are therefore related to protein synthesis needs.⁹ PLP may be decreased during acute phase reaction;¹⁴ therefore the interpretation of PLP concentration is more complicated in the presence of inflammation or infection.

PLP was not measured in previous NDNS. Instead erythrocyte aspartate aminotransferase activation coefficient (EAATAC) was measured as an index of vitamin B₆ status.

There is currently no internationally recognised normal range for PLP concentration. Pyridoxic acid (PA), a less sensitive measure of vitamin B₆ status but less affected by acute phase, was also measured; results for PA are presented in Appendix Q.

The mean PLP concentration was 78.6nmol/L for boys aged 11 to 18 years and 59.1nmol/L for girls aged 11 to 18 years.

The mean PLP concentration for men aged 19 to 64 years was 68.7nmol/L, 48.2nmol/L for women aged 19 to 64 years and 44.9nmol/L for those aged 65 years and over.

(Table 6.2)

6.4 Fat-soluble vitamins and carotenoids

6.4.1 Plasma retinol (vitamin A) (micromoles/litre, μ mol/L)

Plasma retinol is related to long-term dietary intake of vitamin A. The plasma concentration is homeostatically controlled and there is little variation either within or between individuals who are not vitamin A deficient.¹⁵ For adults, concentrations below 0.35 μ mol/L are considered to reflect severe deficiency and concentrations between 0.35 μ mol/L and 0.70 μ mol/L to reflect mild deficiency.¹¹

The mean plasma retinol concentration was 1.64 $\mu\text{mol/L}$ for boys aged 11 to 18 years and 1.60 $\mu\text{mol/L}$ for girls aged 11 to 18 years.

The mean plasma retinol concentration for men aged 19 to 64 years, women aged 19 to 64 years and those aged 65 years and over were 2.16 $\mu\text{mol/L}$, 2.00 $\mu\text{mol/L}$ and 2.00 $\mu\text{mol/L}$ respectively. Thus, the mean concentration for all age/sex groups was above the limit of marginal status for retinol.

There were no cases of children aged 11 to 18 years or adults aged 19 years and over with a plasma retinol concentration below the level associated with severe deficiency in an adult population (0.35 $\mu\text{mol/L}$) nor at a level associated with mild deficiency in an adult population (0.35-0.70 $\mu\text{mol/L}$).¹¹

(Table 6.3)

6.4.2 Plasma α - and β -carotene and α - and β -cryptoxanthin (micromoles/litre, $\mu\text{mol/L}$)

α - and β -carotene and α - and β -cryptoxanthin are carotenoids with provitamin A activity and their plasma concentrations reflect short to medium term dietary intake. Plasma concentrations of these carotenoids may also be influenced by conversion to vitamin A, the conversion being dependent on vitamin A status and requirements. There are currently no established normal ranges for plasma α - and β -carotene or α - and β -cryptoxanthin concentrations.

Results for plasma concentrations of α - and β -carotene and α - and β -cryptoxanthin are shown in Table 6.3.

(Table 6.3)

6.4.3 Plasma lycopene and plasma lutein and zeaxanthin (micromoles/litre, $\mu\text{mol/L}$)

Lycopene, lutein and zeaxanthin are also carotenoids but do not have provitamin A activity. Plasma lutein and zeaxanthin concentrations may be useful markers of green vegetable intakes. There are currently no established normal ranges for the plasma concentrations of these carotenoids.

Results for plasma concentrations of lycopene, lutein and zeaxanthin are shown in Table 6.3.

(Table 6.3)

6.4.4 Plasma 25-hydroxyvitamin D (nanomoles/litre, nmol/L)

Plasma 25-hydroxyvitamin D (25-OHD) concentration is a measure of vitamin D status and reflects the availability of vitamin D in the body from both dietary and endogenous sources. Plasma 25-OHD is derived from synthesis in the skin of vitamin D₃ and its precursors during ultraviolet B irradiation from sunlight and from vitamin D₂ and D₃ and their precursors in the diet. Factors such as season of the year, time spent outdoors, habit of dress and consumption of foods and supplements containing vitamin D therefore influence 25-OHD. This metabolite has a long half-life in plasma and gives an indication of vitamin D availability over recent weeks. Vitamin D, after conversion to its active metabolite 1,25-dihydroxyvitamin D, facilitates calcium absorption from the intestine and is important for a range of other metabolic processes. In the UK 25nmol/L of 25-OHD has been used as the lower threshold for vitamin D adequacy below which there is an increased risk of rickets and osteomalacia.^{16,17} A higher threshold has been adopted by some countries to indicate population vitamin D sufficiency; the UK Scientific Advisory Committee on Nutrition (SACN) convened a working group in 2011 to review the thresholds and is expected to report in 2015.

Plasma 25-OHD concentration is not split by season in this report due to small sample sizes. As the survey was spread evenly across the year, values in Table 6.3 are year-round averages.

The mean 25-OHD concentration for boys aged 11 to 18 years was 38.5nmol/L and 38.7nmol/L for girls aged 11 to 18 years.

The mean 25-OHD concentration for men aged 19 to 64 years was 36.8nmol/L, 42.3nmol/L for women aged 19 to 64 years and 45.1nmol/L for those aged 65 years and over.

The proportion of children who had a 25-OHD concentration below 25nmol/L at the time of venepuncture was 24.8% of boys aged 11 to 18 years and 34.5% of girls aged 11 to 18 years.

The proportion of adults who had a 25-OHD concentration below 25nmol/L at the time of venepuncture was 35.6% of men aged 19 to 64 years, 33.0% of women aged 19 to 64 years and 18.7% of those aged 65 years and over.

(Table 6.3)

6.4.5 Plasma (alpha) α -tocopherol (micromoles/litre, $\mu\text{mol/L}$)

Vitamin E is a group of compounds called tocopherols. α -tocopherol is the predominant form of vitamin E in human tissue, and has the highest biological activity of the tocopherols. It acts as an antioxidant and is required to protect cells against oxidative damage by free radicals, for example oxidation of the lipids in cell membranes. Plasma α -tocopherol concentration can be used as a measure of vitamin E status.

Increased concentration of plasma lipids appear to cause tocopherols to partition out of cell membranes, thus increasing plasma concentrations of tocopherols and resulting in a correlation between tocopherols and total lipid in the blood, particularly with the cholesterol fraction. For this reason plasma α -tocopherol concentration can be usefully expressed as a ratio to plasma total cholesterol ($\mu\text{mol}/\text{mmol}$), enabling comparisons to be made between groups with different plasma lipid concentrations.

For adults, a concentration of total plasma tocopherols below $11.6\mu\text{mol/L}$, of which approximately 93% would be α -tocopherol, or a plasma tocopherol to cholesterol ratio of below $2.25\mu\text{mol}/\text{mmol}$, tends to cause red blood cells to haemolyse after exposure to oxidising agents *in vitro*; this is a functional test for biochemical vitamin E deficiency, although it is not necessarily indicative of a clinical deficiency of vitamin E. There is currently no established normal range for plasma α -tocopherol concentration. The Committee on Medical Aspects of Food and Nutrition Policy (COMA) Panel on Dietary Reference Values considered a tocopherol to cholesterol ratio of $2.25\mu\text{mol}/\text{mmol}$ to be the lowest satisfactory value for adults.⁹

The mean plasma α -tocopherol concentration was $24.6\mu\text{mol/L}$ for boys aged 11 to 18 years and $23.4\mu\text{mol/L}$ for girls aged 11 to 18 years. The mean plasma α -tocopherol concentration for men aged 19 to 64 years, women aged 19 to 64 years and those aged 65 years and over was $29.9\mu\text{mol/L}$, $30.7\mu\text{mol/L}$ and $31.7\mu\text{mol/L}$ respectively.

α -tocopherol results expressed as μmol per mmol total cholesterol have also been provided in Table 6.3 for each age/sex group.

The mean ratio of α -tocopherol to total cholesterol for boys aged 11 to 18 years and girls aged 11 to 18 years was $6.43\mu\text{mol}/\text{mmol}$ and $5.90\mu\text{mol}/\text{mmol}$ respectively. The proportion of children with a ratio of α -tocopherol to total cholesterol below the lowest satisfactory value defined for an adult population⁹ was 2.5% of girls aged 11 to 18 years. There were no cases of boys aged 11 to 18 years having a ratio of α -tocopherol to total cholesterol lower than the lowest satisfactory value defined for an adult population.⁹⁹

The mean ratio of α -tocopherol to total cholesterol was $6.21\mu\text{mol}/\text{mmol}$ for men aged 19 to 64 years, $6.22\mu\text{mol}/\text{mmol}$ for women aged 19 to 64 years and $6.42\mu\text{mol}/\text{mmol}$ for those aged 65 years and over. The proportion of men aged 19 to 64 years who had a ratio of α -tocopherol to total cholesterol lower than the lowest satisfactory value was 2.7%, whilst and there were no cases for women aged 19 to 64 years or those aged 65 years and over having a ratio of α -tocopherol to total cholesterol lower than the lowest satisfactory value.

(Table 6.3)

6.5 Blood lipids

6.5.1 Total cholesterol, high density lipoprotein (HDL) cholesterol and low density lipoprotein (LDL) cholesterol (millimoles/litre, mmol/L)

High circulating concentrations of serum total cholesterol and LDL cholesterol are among the predictors of coronary heart disease (CHD) and other vascular diseases in adults. They are affected by age, genetic and environmental influences, including dietary factors, notably the amount of saturated fatty acids in the diet.¹⁸ High concentrations of total cholesterol occur in some diseases, for example kidney, liver and thyroid disorders and in diabetes.

Cholesterol circulates in the body carried by a variety of lipoproteins. Cholesterol transported in low density lipoproteins (LDL cholesterol) is the major proportion of total circulating cholesterol. In adults, the risk of CHD is positively correlated with the concentration of both serum total cholesterol and LDL cholesterol. Cholesterol transported in high density lipoproteins (HDL cholesterol) is a smaller proportion of the total circulating cholesterol and is inversely related to the development of CHD. It is generally accepted that a serum total cholesterol concentration below 5.2mmol/L represents a level associated with minimal CHD risk, 5.2mmol/L to 6.4mmol/L mildly elevated risk, 6.5mmol/L to 7.8mmol/L moderately elevated risk and above 7.8mmol/L a severely elevated level of risk.¹⁹

LDL cholesterol was not directly measured in the NDNS RP but it was calculated in samples taken after an overnight fast by subtraction of HDL cholesterol from serum total cholesterol and corrected for very low density lipoprotein (VLDL) cholesterol estimated from the serum triglyceride concentration using the Friedewald equation.²⁰ Serum triglyceride (triacylglycerol) concentrations are presented in Appendix Q of this report.

Table 6.4 shows the mean serum total, HDL and LDL cholesterol concentration for children and adults. In adults aged 19 to 64 years and 65 years and over, 35.4% and 16.9% respectively had a serum total cholesterol between 5.2 and 6.4mmol/L, indicating a marginally increased risk of cardiovascular disease.

The proportion of adults with a serum total cholesterol between 6.5 and 7.8mmol/L indicating moderately elevated cardiovascular risk ranged from 7.6% for those aged 19 to 64 years to 22.9% for those aged 65 years and over. The proportion of adults with a total serum cholesterol above 7.8mmol/L indicating severe risk ranged from no cases for those aged 65 years and over to 1.0% for those aged 19 to 64 years.

(Table 6.4)

6.6 Selenium and zinc

6.6.1 Plasma selenium (micromoles/litre, $\mu\text{mol/L}$)

Selenium, an essential trace element, forms part of the structure of certain proteins, and plays a key role in a number of metabolic processes including antioxidant systems and thyroid hormone metabolism. There are well-confirmed pathological syndromes associated with selenium deficiency as well as selenium toxicity.²¹ There is currently no established normal range for plasma selenium concentration. Plasma selenium concentration was not measured for participants aged 1.5 to 6 years because the small volume of blood taken from these children precluded including these analyses

Mean plasma selenium concentration was $0.85\mu\text{mol/L}$ for boys aged 11 to 18 years and $0.86\mu\text{mol/L}$ for girls aged 11 to 18 years.

Mean plasma selenium concentration was similar across all age/sex groups for adults with a mean concentration of $1.01\mu\text{mol/L}$ for men aged 19 to 64 years, $1.00\mu\text{mol/L}$ for women aged 19 to 64 years and $0.99\mu\text{mol/L}$ for those aged 65 years and over.

(Table 6.5)

6.6.2 Plasma zinc (micromoles/litre, $\mu\text{mol/L}$)

Zinc, an essential trace element, has a regulatory and catalytic role in numerous enzymes and also has a structural role in a number of enzymes and non-enzymatic proteins. Zinc also plays a role in major metabolic pathways which contribute to protein, carbohydrate, lipids, nucleic acids and energy metabolism.⁹ There is currently no established normal range for plasma zinc concentration. Plasma zinc concentration was not measured for participants aged 1.5 to 6 years because the small volume of blood taken from these children precluded including these analyses.

Mean plasma zinc concentration was $15.34\mu\text{mol/L}$ for boys aged 11 to 18 years and $15.09\mu\text{mol/L}$ for girls aged 11 to 18 years.

Mean plasma zinc concentration was 15.08 μ mol/L for men aged 19 to 64 years, 13.37 μ mol/L for women aged 19 to 64 years and 13.03 μ mol/L for those aged 65 years and over respectively.

(Table 6.5)

6.7 Summary of the nutritional status of the population

Analysis of blood samples can provide an indication of the level of nutrients available to the body (after absorption) for use in metabolic processes.

There is evidence of anaemia (as indicated by low haemoglobin levels) or low iron stores (plasma ferritin) in all age/sex groups in the population; the incidence is low in males and higher in females. In women aged 19 to 64 years 4.2% had concentrations below the threshold for both haemoglobin and plasma ferritin.

There is evidence of low vitamin D status at the time of venepuncture in all reported age/sex groups (as shown in Table 6.3 of this chapter); this has implications for bone health, in particular increasing the risk of rickets and osteomalacia.

A substantial proportion of participants aged four years and over had riboflavin status values based on raised EGRAC indicating biochemical depletion. However, there is uncertainty about the functional consequences of a raised EGRAC. Therefore, in addition to using this threshold, changes in the riboflavin status of the UK population will also be monitored by reviewing the EGRAC values at the 75th and 90th percentiles in successive years (see Table 6.2).

There is little evidence of low status for other micronutrients where normal ranges or thresholds for low status have been set. Mean values for vitamin C, B₁₂, thiamin as indicated by ETKAC, retinol and vitamin E fell within the normal range.

In adults aged 19 to 64 years and 65 years and over, 7.6% and 22.9% respectively had a serum total cholesterol between 6.5 to 7.8mmol/L indicating a moderately elevated cardiovascular risk and another 1.0% of adults aged 19 to 64 years had a serum total cholesterol greater than 7.8mmol/L, indicating severe risk.

6.8 Comparisons between the Northern Ireland sample of the NDNS RP and the UK Years 1 to 4 combined

The following should be taken into consideration when making any comparisons between the Northern Ireland and UK data:

- The number of blood samples obtained in Northern Ireland was 365 (of which 360 were from those aged 11 years and over).¹ The number of blood samples obtained from UK participants²² was 2,671.
- All of the noted differences are observed differences only and no statistical analysis of the differences has been undertaken.
- Plasma 25-hydroxyvitamin D (25-OHD) data have only been presented as annual averages in Table 6.3, due to small cell sizes for the majority of sex- combined age groups once the data are split by season.

6.8.1 Key differences identified

- There was evidence of iron-deficiency anaemia (as indicated by low haemoglobin concentrations) and low iron stores (plasma ferritin) in a proportion of adult women and older girls in both Northern Ireland and the UK as a whole. The proportion with a haemoglobin concentration and a plasma ferritin concentration below which iron deficiency is indicated was 4.2% and 4.7% of women aged 19 to 64 years for Northern Ireland and the UK as a whole respectively.
- There is evidence of low vitamin D status in all age/sex groups in both Northern Ireland and the UK as a whole. Low vitamin D status has implications for bone health, including increasing the risk of rickets and osteomalacia.
- In all age/sex groups, except those aged 65 years and over (sex combined), a higher proportion of participants in Northern Ireland had a 25-OHD concentration below 25nmol/litre (the current threshold indicating vitamin D adequacy) at the time of venepuncture. Results are summarised in Table 6B.

Table 6B: The percentage of NDNS RP Years 1 to 4 Northern Ireland and UK participants with 25-OHD concentration below 25nmol/L at the time of venepuncture

NDNS RP Y1-4	% of respective dataset with 25-OHD concentration <25nmol/litre				
	11-18y boys	11-18y girls	19-64y men	19-64y women	65+ (sex combined)
Northern Ireland	24.8%	34.5%	35.6%	33.0%	18.7%
UK as a whole	19.7%	24.4%	24.0%	21.7%	21.0%

¹ No blood samples were obtained from children in the youngest age group (i.e. those aged 1.5 to 3 years) and only a small number (5) were obtained from those aged 4 to 10 years (3% response rate). This pattern mirrors the experience in the rest of the UK but was also exacerbated in Northern Ireland by the lack of a paediatric phlebotomist available to take blood samples from younger children. Therefore blood analyte results have not been included in this report for children aged under 10 years due to the low number of samples collected.

² <http://www.data-archive.ac.uk> (accessed 29/04/14).

³ Participants were classed as “fully productive” if they completed three or four days of the food and drink diary.

⁴ Hornung, RW, Reed, LD. Applied Occupational and Environmental Hygiene, 1990, 5: 46-51.

⁵ UK Y1-4 NDNS RP report: <https://www.gov.uk/government/publications/national-diet-and-nutrition-survey-results-from-years-1-to-4-combined-of-the-rolling-programme-for-2008-and-2009-to-2011-and-2012> (accessed 08/08/14).

⁶ World Health Organization. Iron Deficiency Anaemia; Assessment, Prevention, and Control: A guide for programme managers. WHO (Geneva, 2001).

⁷ Scientific Advisory Committee on Nutrition. *Iron and Health*. The Stationery Office (London, 2010).

⁸ Sauberlich HE. Vitamin C status: methods and findings. Annals of the New York Academy of Sciences, 1971; 24: 444–454.

⁹ Committee on Medical Aspects of Food Policy, *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*, Department of Health Report on Health (1991).

¹⁰ WHO. Conclusions of a WHO technical consultation on folate and vitamin B₁₂ deficiencies. *Food and Nutrition Bulletin*. 2008; 29. S238–S244.

¹¹ Bates CJ, Thurnham DI, Bingham SA, Margetts BM, Nelson M. Biochemical Markers of Nutrient Intake. In: *Design Concepts in Nutritional Epidemiology*. 2nd Edition. OUP (Oxford, 1997), pp 170–240.

¹² Hill MH, Bradley A, Mustaq S, Williams EA, Powers HJ. Effects of methodological variation on assessment of riboflavin status using the erythrocyte glutathione reductase activation coefficient assay. *British Journal of Nutrition*, 2009; 102 (2): 273-8.

¹³ Powers HJ, Hill MH, Mushtaq S, Dainty JR, Majsak-Newman G, Williams EA. Correcting a marginal riboflavin deficiency improves hematologic status in young women in the United Kingdom (RIBOFEM). *American Journal of Clinical Nutrition*, 2011; 93(6):1274-84.

¹⁴ Friso S, Girelli D, Martinelli N, Olivieri O, Lotto V, Bozzini C, Pizzolo F, Faccini G, Beltrame F, Corrocher R. Low plasma vitamin B-6 concentrations and modulation of coronary artery disease risk. *American Journal of Clinical Nutrition*, 2004; 79 (6): 992-8.

¹⁵ Green MH, Green JB 'Dynamics and control of plasma retinol. In: *Vitamin A in Health and Disease*. Marcel Dekker Inc., (New York, 1994) Pp 119-133.

¹⁶ Department of Health Report on Health and Social Subjects, No. 49. Nutrition and bone health with particular reference to calcium and vitamin D. TSO (London, 1998).

¹⁷ Bates CJ, Carter GD, Mishra GD, O'Shea D, Jones J, Prentice A. In a population study, can parathyroid hormone aid the definition of adequate vitamin D status? A study of people aged 65 years and over from the British National Diet and Nutrition Survey. *Osteoporosis International*, 2003; 14: 152-9.

¹⁸ Department of Health. Report on Health and Social Subjects: 46. Nutritional Aspects of Cardiovascular Disease. HMSO (London, 1994).

¹⁹ The British Cardiac Society, British Hyperlipidaemia Association, British Hypertension Society, endorsed by the British Diabetic Association, have issued guidance published in the article 'Joint British recommendations on prevention of coronary heart disease in clinical practice'. *Heart*, 1998; 80: 1–29.

²⁰ Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clinical Chemistry* 1972;18: 499-502.

²¹ Rayman MP. The importance of selenium to human health. *Lancet*, 2000; 356: 233–41.

²² It should be noted that this number also includes the blood samples obtained from participants in Northern Ireland.

7 24-hour urine analyses: Sodium excretion and estimated salt intake

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Erratum note: Correction to data

This chapter was excluded from the original report published in February 2015 in order that the data could be corrected to take account of bias in the sodium concentrations. This correction has now been applied and the data published in this chapter are in line with the data republished in the UK Years 1 to 4 report in February 2017 and the urinary sodium surveys of adults in England and Scotland (2014)^{1,2} and Northern Ireland (2015).³ Data are available in the UK Data Archive⁴ for urinary sodium concentration (mmol/L) and excretion (mmol/24-hour) with and without application of the correction factor. This chapter has not been updated to reflect the new results for salt intakes for adults in England (2014)¹ and Scotland (2014)² and Northern Ireland (2015).³

Published figures for estimated salt intake from previous sodium surveys^{5,6,7,8,9,10} have also recently been revised to take account of analytical bias in the instruments used at the time of measuring sodium concentration in the samples for the respective surveys. These revisions facilitate comparisons between surveys over time. Descriptive statistics and cumulative frequencies for adjusted sodium excretion and estimated salt intake data for the England 2006, UK 2008 and England 2011 sodium surveys are presented in tables E.1-E.12 of the England 2014 report.¹

Further details of the correction can be found in appendix U of this report and in the reports for the England and Scotland 2014 and Northern Ireland sodium surveys.^{1,2,3}

7.1 Introduction

This chapter presents the estimated salt intakes based on 24-hour urinary sodium excretion data from participants aged 11 to 64 years¹¹ in Northern Ireland in Years 1 to 4 combined of the National Diet and Nutrition Survey Rolling Programme (NDNS RP).

The RP data presented here add to previous publications on estimated salt intake in adults aged 19 to 64 years in UK countries.^{5,6,7,8,9,10} Key results are highlighted in section 7.5 of this chapter. Data presented in this chapter provides an estimate of the progress of the population aged 11 years and over towards meeting UK Health Departments' targets to reduce the average population salt intakes to no more than 3g/day for those aged 4 to 6 years, no more than 5g/day for those aged 7 to 10 years and no more than 6g/day for those aged 11 years and over.^{12,13} The Reference Nutrient Intakes (RNI)¹⁴ for sodium, set in 1991 by the Committee on Medical Aspects of Food and Nutrition Policy's (COMA) panel on Dietary Reference Values,¹⁵ are presented in table 7A for each age group. The table also shows the corresponding recommended maximum salt intake per day for adults, which was set by COMA¹² and endorsed by the Scientific Advisory Committee on Nutrition (SACN) in its report on Salt and Health (2003) and the recommended maximum intakes set by SACN (2003) for children.¹³

Table 7A The Reference Nutrient Intake (RNI)^{14,15} for sodium and the corresponding maximum recommended salt intake per day^{12,13}

NDNS age group	RNI ^{14,15} (mmol sodium per day*)	Maximum recommended salt intake ^{12,13**} (g per day*)
4 to 6 years	30	3
7 to 10 years	50	5
11 to 18 years	70	6
19 to 64 years	70	6
65 years and over	70	6

*1g salt contains 17.1mmol sodium.

** These are the maximum daily dietary targets

Dietary salt intake can only be accurately assessed by measuring sodium excretion in urine. Salt is the predominant source of sodium in the UK diet and an estimation of intake from excretion is more reliable than through dietary assessment as it is difficult to quantify discretionary salt used in cooking and at the table. Estimates of sodium intake can be obtained by measuring urinary sodium excretion, assuming the body is in balance for sodium. Sodium is readily and rapidly absorbed from the diet, its concentration in plasma is under tight homeostatic control and the excess is excreted rapidly in urine.

Sodium excretion in single (“spot”) urine samples is not a reliable indicator of salt intake because both the excretion of sodium and the excretion of water fluctuate greatly during the day according to what was eaten at the last meal and how much fluid an individual has drunk; hence the concentration of sodium in spot urine samples is very variable. A 24-hour urine collection is accepted as being the most reliable method for assessing population mean salt intake.¹³ Therefore, as for the previous England and Scotland sodium surveys^{9,10} and recently published sodium data for adults,^{1,2,3} the 24-hour urine methodology was used for the NDNS RP, facilitated by the nurses during their visits to participants.

To be representative of daily salt intake the 24-hour collection has to be complete; this can be assessed by orally administering para-aminobenzoic acid (PABA) and measuring its excretion in the 24-hour urine collection.¹⁶ Where participants were excluded from taking PABA¹⁷ or were unwilling to do so, or where participants failed to take the required PABA dose, assessment of

complete collections was reliant on information recorded by participants on the 24-hour urine record sheet (see appendix T).

Results for measurement of sodium excretion and estimated salt intake are provided in this chapter and in tables 7.1-7.4 using only those 24-hour urine collections that were classified as complete. Pre-determined criteria were used to determine completeness (see section 7.4 of this chapter and appendix T for more details). Supporting information about the 24-hour urine collection and the results of other urine analyses are provided in other sections of the report as follows:

- data on excretion of potassium, nitrogen, urea and creatinine are described in appendix S
- an overview of the purpose, methodologies and other procedures associated with collecting 24-hour urine samples, as well as the response rates achieved, are provided in chapters 1 to 3
- appendix T details the procedures for obtaining written consent from adult participants and the parent/legal guardian of child participants, including child assent where appropriate, prior to the 24-hour urine collection
- appendix T also provides information about obtaining the 24-hour urine collection (including the administration of PABA), the processing of the urine aliquots, categorisation of collections as “complete” or “incomplete/unreliable” and the representativeness of urine collections deemed to be complete and included in the data analysis
- appendix U of this report details the quality control data and methodology of urine analysis for sodium along with details of the derivation of a method-specific factor to enhance accuracy of sodium results relative to a national consensus reference and to facilitate comparison with previous sodium surveys^{5,6,7,8,9,10} and recently published data for adults.^{1,2,3} Appendix U of this report also includes quality control data and methodology for other urine analytes reported in appendix S
- appendix W details which analytes are reported for Years 1 to 4 combined, as well as providing details about those analytes that are not reported here but will be included in the dataset deposited at the UK Data Archive⁴

All urine excretion data have been weighted to account for differential non-response in providing a 24-hour urine collection, in order to adjust for any bias arising from refusals to provide a 24-hour urine collection and also failure to provide a complete 24-hour urine collection; incomplete collections were excluded from the descriptive statistics.

7.2 Urine collection and processing

Eligible participants aged four years and over who agreed to the nurse visit were asked to provide a 24-hour urine collection for measurement of sodium excretion and other urinary analytes. Full details of the 24-hour urine collection protocol are given in appendix T.

The nurse visited the participant as soon as possible after the end of the collection period to process the urine. All urine from the 24-hour period was collected in a 5 litre bottle. The bottle containing the 24-hour urine collection was weighed twice by the nurse to determine urine volume and was thoroughly mixed prior to filling four monovette tubes with a representative aliquot of the urine. These were sent by post to HNR for storage at -20°C and later analysis of sodium, potassium, urea, creatinine and nitrogen (see appendix U of this report); urine remaining after analysis was retained at -20°C, where consent had been given for storage and use in future research. Appendix T provides further details on urine processing and storage.

7.3 Results used in the data analysis

For the age groups reported in this chapter (participants aged 11 to 64 years) 408 24-hour urines (from 171 males and 237 females) were received at HNR and a total of 407 sodium results were obtained (from 170 males and 237 females). Of these 24-hour urines with a sodium result, 56.5% of collections (230) were classified as 'complete by standard criteria' and are included in the descriptive statistics in tables 7.1 to 7.4; 43.5% (177) were classified as 'incomplete or unreliable by standard criteria' and have been omitted from the descriptive statistics (see section 7.4.1 below for details about the 'standard criteria').

Sodium concentrations were converted to mmol/24hr based on the weight of the full urine collection in kg and assuming a specific gravity of 1.0kg/litre. Urinary sodium excretion data

were adjusted using a method-specific factor (i.e. multiplied by 1.052) in order to correct for analytical bias and to enable comparison with results from recent and previous urinary sodium surveys of adults which have also been corrected.^{1,2,3,5,6,7,8,9,10} Application of this factor has resulted in slightly higher estimates of salt intake compared with the previously published figures (for information on the derivation of this factor see appendix U of this report). This chapter has not been updated to reflect these new results for salt intakes for adults in England (2014)¹ and Northern Ireland (2015).³

In line with previous surveys, estimated salt intake was calculated from corrected 24-hour urinary sodium excretion using the equation:

17.1mmol of sodium excreted = 1 g of salt consumed.

This assumes that the dietary intake of sodium is equal to the urinary output, and that all sodium in the diet comes from salt.

7.4 Assessment of completeness of collection

Sodium excretion in the urine approximates to 24-hour intake of sodium in the diet only if the 24-hour urine collection is complete. Full details of the procedures used to establish completeness and the criteria applied to categorise the urine collections are given in appendix T.

Details regarding the number and representativeness of useable collections for the different age/sex groups are presented in appendix T and tables T.1-T.3.

7.4.1 Standard criteria for classifying complete collections

24-hour urine collections were classified as 'complete' or 'incomplete/unreliable' by either of two criteria: 'complete by PABA' (where the participant has reported taking three PABA tablets and the amount of PABA recovered in the urine collection is consistent with completeness) or 'complete by claim' (where the participant has reported taking less than three PABA tablets and reported (i.e. claimed) collection of all urine passed during 23 to 25 hours), jointly referred to as

'standard criteria'. For participants aged 11 years and over, only results of urine collections classified as complete by these criteria are included in the results data (tables 7.1 to 7.4).

7.5 Sodium excretion and estimated salt intake results

Table 7.1 provides mean urinary sodium excretion by age/sex group expressed as mmol per 24 hours (mmol/24hr), table 7.2 shows the cumulative percentage distribution of urinary sodium excretion per 24 hours. Table 7.3 provides mean estimated salt intake by age/sex group expressed as gram per 24 hours (g/24hr). Table 7.4 shows the cumulative percentage distribution of estimated salt intake per 24 hours. Tables 7.1-7.4 provide data for children aged 11 to 18 years (females only and sex combined) and adults aged 19 to 64 years (split by sex and sex combined). As explained above, these data have been revised to take into consideration the method specific factor (see appendix U of this report).

Table 7.3 shows that, based on the standard criteria for determining completeness of urine collections, the numbers were too low to calculate a population average estimated salt intake for children aged 4 to 10 years, males aged 11 to 18 years and adults aged 65 years and over in Northern Ireland.

Mean estimated salt intake for adults aged 19 to 64 years and for children aged 11 to 18 years exceeded the maximum recommended intake while mean intake for females aged 11 to 18 years met the recommendation.^{12,13,18}

The mean urinary sodium excretion for children aged 11 to 18 years was 115mmol/24hr.

The mean estimated salt intake for children aged 11 to 18 years was 6.7g/day; 12% greater than the SACN recommendation of a population average of no more than 6g/day.^{12,13} The population distribution was skewed towards higher values; the median estimated salt intake for children aged 11 to 18 years was 6.5g/day.

Mean urinary sodium excretion was 165mmol/24hr for men aged 19 to 64 years and 129mmol/24hr for women aged 19 to 64 years.

The mean estimated salt intake for adults aged 19 to 64 years was 8.6g/day, this was 43% greater than the SACN recommendation of a population average of no more than 6g/day.^{12,13} Men had a mean daily intake of 9.7g/day and women had a mean daily intake 7.5g/day. The population distribution for adults and women aged 19 to 64 years was skewed towards higher values; the median estimated salt intake for the adult population was 8.5g/day and 6.8g/day for women.

(Tables 7.1, 7.2, 7.3 and 7.4)

7.6 Comparison with the previously published urinary sodium surveys

Since this report was originally published new data have been published for salt intakes for adults in England (2014)¹ and Northern Ireland (2015).³ This section has not been updated to reflect these new results. Prior to this report, estimated salt intake data based on 24-hour urinary sodium excretion for adults aged 19 to 64 years in England came from a 24-hour urinary sodium survey carried out in 2011,^{9,19} which used the same methods for fieldwork and for analysis of sodium excretion and PABA recovery as those used concurrently in the NDNS RP. The report for Years 1 to 4 of the NDNS RP^{Error! Bookmark not defined.} reported urinary sodium results from participants aged 4 to 18 years and 65 years and over only, and not for those aged 19 to 64 years.

The mean estimated salt intake for adults aged 19 to 64 years in England in 2011¹⁹ (8.5g per day) was similar to the NDNS RP in Northern Ireland 2008/09-2011/12 (8.6g per day). Results for men (9.8g per day versus 9.7g per day in Northern Ireland) and women (7.2g per day versus 7.5g per day in Northern Ireland) were also similar.

Due to limited cell sizes for the 11 to 18 years age group in Northern Ireland,²⁰ no comparisons have been made in this report between the mean estimated salt intake in the Northern Ireland NDNS RP and the mean intake in the UK NDNS RP for this age group.

The most recent published data for adults in the Republic of Ireland is from 24-hour urine collections reported in “Dietary salt intake and related risk factors in the Irish population” report published in 2010 (referred to in this section as the 2010 Irish salt report).²¹ Fieldwork took place during 2008/09.

It should be noted that:

- a) the 2010 Irish salt report does not indicate which analytical method was used to measure urinary sodium and therefore analytical results may not be comparable with those reported here
- b) the sodium content of marginally incomplete collections was included in the dataset after application of an adjustment equation.²² In contrast, all collections deemed incomplete were excluded from the NDNS RP dataset and adjustment equations were not used
- c) the age range for adults is different in the two surveys: the 2010 Irish salt report sample is 17 years and over whereas in the NDNS RP it is 19 to 64 years

These methodological differences mean that comparisons between estimates of salt intake determined by the two studies are not robust and should be interpreted with caution.

The mean estimated salt intake for men aged 17 years and over in the 2010 Irish salt report²¹ was 10.4g per day, which was higher than mean estimated salt intake for men aged 19 to 64 years in the NDNS RP in Northern Ireland (9.7g per day). Results for women aged 17 years and over in the 2010 Irish salt report was 7.4g per day, which was similar to mean estimated salt intake for women aged 19 to 64 years in the NDNS RP in Northern Ireland (7.5g per day).

A new urinary survey in Northern Ireland in 2015 study published in 2016 provides evidence to help determine whether intakes of salt in Northern Ireland are decreasing.^{23,3} The urinary sodium survey of adults in 2014 in Scotland² which ran concurrently with a urinary sodium survey in England¹ which were published in 2016, allow comparisons of estimated salt intakes between Northern Ireland and the two countries.

¹ National Diet and Nutrition Survey (NDNS): Assessment of dietary sodium for adults (19 to 64 years) in England, 2014 report; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/509399/Sodium_study_2014_England_Text_final.pdf Published 2016 (accessed 27/06/16).

² National Diet and Nutrition Survey (NDNS): Assessment of dietary sodium for adults (19 to 64 years) in Scotland, 2014 report; http://www.foodstandards.gov.scot/sites/default/files/Monitoring%20the%20Scottish%20Diet-%20Sodium%20Survey%202014%20SCOTLAND_FINAL%20PDF.pdf Published 2016 (accessed 27/06/16).

- ³ National Diet and Nutrition Survey: Assessment of dietary sodium - Adults (19 to 64 years) in Northern Ireland 2015;
<https://www.food.gov.uk/northern-ireland/nutritionni/national-diet-and-nutrition-survey-assessment-of-dietary-sodium>. Published 2016 (accessed 06/10/16).
- ⁴ <http://data-archive.ac.uk/> (accessed 22/10/15).
- ⁵ An assessment of dietary sodium levels among adults (aged 19-64) in the general population, based on analysis of sodium in 24 hour urine samples. Oct 2006
<http://webarchive.nationalarchives.gov.uk/20101211052406/http://www.food.gov.uk/multimedia/pdfs/englandsodiumreport.pdf> (accessed 22/10/15).
- ⁶ Joint Health Surveys Unit (NatCen and UCL). A survey of 24 hour and spot urinary sodium and potassium excretion in a representative sample of the Scottish population. Food Standards Agency Scotland, 2007:
<http://tna.europarchive.org/20110116113217/http://www.food.gov.uk/multimedia/pdfs/scotlandsodiumreport.pdf> (accessed 22/10/15).
- ⁷ An assessment of dietary sodium levels among adults (aged 19-64) in the general population in Wales based on analysis of dietary sodium in 24 hour urine samples. Feb 2007.
<http://webarchive.nationalarchives.gov.uk/20101211052406/http://www.food.gov.uk/multimedia/pdfs/walessodiumreport.pdf> (accessed 22/10/15).
- ⁸ An assessment of dietary sodium levels among adults (aged 19-64) in the UK general population in 2008, based on analysis of dietary sodium in 24 hour urine samples, June 2008;
<http://tna.europarchive.org/20110116113217/http://www.food.gov.uk/multimedia/pdfs/08sodiumreport.pdf> (accessed 22/10/15).
- ⁹ National Diet and Nutrition Survey - Assessment of dietary sodium in adults (aged 19 to 64 years) in England, 2011 report. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/127916/Sodium-Survey-England-2011_Text_to-DH_FINAL1.pdf (accessed 22/10/15).
- ¹⁰ A survey of 24 hour urinary sodium excretion in a representative sample of the Scottish population as a measure of salt intake. Published April 2011. <http://www.foodstandards.gov.scot/survey-24-hour-urinary-sodium-excretion-representative-sample-scottish-population-measure-salt> (accessed 22/10/15).
- ¹¹ Due to small cell sizes for those aged 4 to 6 years (41 urine collections were provided of which 11 were complete by the standard criteria or 12 by the child claim only criteria), those aged 7 to 10 years (70 urine collections were provided of which 21 were complete by the standard criteria or 23 by the child claim only criteria) and those aged 65 years and over (46 urine collections were provided of which 23 were complete by the standard criteria), data are only provided in this chapter for participants in Northern Ireland aged 11 to 64 years.
- ¹² Department of Health. Report on Health and Social Subjects: 46. Nutritional Aspects of Cardiovascular Disease. HMSO (London, 1994).
- ¹³ Scientific Advisory Committee on Nutrition (2003). Salt and Health. The Stationery Office.
http://www.sacn.gov.uk/pdfs/sacn_salt_final.pdf (accessed 22/10/15).
- ¹⁴ The RNI for a vitamin or mineral is the amount of the nutrient that is considered to be sufficient for 97.5% of people in the group. If the average intake of the group is at the RNI, then the risk of deficiency in the group is judged to be very small. However, if the average intake is lower than the RNI then it is possible that some of the group will have an intake below their requirement. For children and adults, health benefits would be gained from a reduction in average salt consumption. The population maximum targets for average salt consumption do not represent an optimal or ideal level of salt consumption but, they represent achievable population goals.
- ¹⁵ Report on Health and Social Subjects 41 *Dietary Reference Values (DRVs) for Food Energy and Nutrients for the UK*, Report of the Panel on DRVs of the Committee on Medical Aspects of Food Policy (COMA) 1991. The Stationery Office. London

¹⁶ Bingham S and Cummings J H. The use of 4-aminobenzoic acid as a marker to validate the completeness of 24h urine collections in man. *Clin Sci (Lond)* 1983; 64(6):629-35.

¹⁷ Exclusions in the NDNS RP for participants taking PABA included those with conditions which could lead to a bad reaction to PABA (e.g. lactose intolerance; a previous allergic reaction to hair dye, sunscreen or a vitamin preparation) or who were taking sulphonamides were excluded from taking PABA.

¹⁸ The COMA and SACN recommendation for maximum daily salt is no more than 3g/day for children aged 4 to 6 years, no more than 5g/day for children aged 7 to 10 years and no more than 6g/day for those aged 11 years and over.

¹⁹ Descriptive statistics and cumulative frequencies for adjusted sodium excretion and estimated salt intake data for the England 2011 sodium survey are presented in tables E.9-E.12 of the National Diet and Nutrition Survey (NDNS): Assessment of dietary sodium for adults (19 to 64 years) in England, 2014 report (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/509399/Sodium_study_2014_England_Text_final.pdf). These tables differ to those presented in the published England 2011 report as the sodium excretion data have been multiplied by a method-specific factor (see table B of chapter 5 of the England 2014 report for more details).

²⁰ The UK report for Years 1 to 4 of the NDNS RP reported urinary sodium results from participants aged 4 to 18 years and 65 years and over only. Results for adults aged 19 to 64 years are not presented in this chapter nor in Tables 7.1 to 7.4 because results for this age group, based on data collected separately and over a shorter time period in England (2011) and Scotland (2009/10) were published in 2012 and 2011 respectively.

²¹ Perry IJ, Browne G, Loughrey M, Harrington J, Lutomski J, Fitzgerald AP (2010). Dietary salt intake and related risk factors in the Irish population. A report for **safefood**. <http://www.safefood.eu/SafeFood/files/80/802be85e-801a-4f94-9097-0849a0e79d18.pdf> (accessed 22/10/15).

²² Johansson G, Bingham S, Vahter M (1999). A method to compensate for incomplete 24-hour urine collections in nutritional epidemiology studies. *Public Health Nutrition*: 2(4), 587-591.

²³ Sodium analysis and identification of complete urine collections from the 2015 Northern Ireland urinary sodium survey will follow the same methods as the NDNS RP as well as the 2014 urinary sodium surveys in England and Scotland, to facilitate comparisons.

8 Detailed age breakdowns for young people and adults for key nutrients and disaggregated foods

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Erratum note: Correction to fruit and vegetable consumption estimates including from composite dishes (section 8.5 and 8.6)

In the first publication of this report (in February 2015), consumption estimates for fruit and vegetables, fruit juice and “5-A-Day” portions, including composite dishes, were incorrectly calculated. Fruit and vegetable components of food groups that should have been excluded (see Appendix A of this report) were mistakenly included. These were: soft drinks, confectionery, biscuits, cakes, sugar, preserves (including jam) and sweet spreads, savoury snacks and ice cream. The results presented in this chapter have been updated to correctly exclude all of the food groups that should be excluded as part of the “5-A-Day” calculations. The corrected values for Years 1-4 are therefore slightly lower than the values originally published but the overall conclusions on fruit and vegetable consumption are unchanged. Details of the methodology for estimating fruit and vegetable consumption and calculating “5-A-Day” portions can be found in Appendix A.

8.1 Introduction

Dietary data for all participants in the Northern Ireland sample in Years 1 to 4 combined of the NDNS Rolling Programme (RP) are presented in Chapter 5 for five standard age groups: 1.5 to 3 years, 4 to 10 years, 11 to 18 years, 19 to 64 years and 65 years and over. Within two of the standard age groups, 11 to 18 years and 19 to 64 years, there are sub-age groups of particular interest in terms of intakes of specific foods or nutrients (for example, alcohol intake in young people aged 16 to 24 years), or who have specific requirements (such as folate intake for women of child-bearing age).

Results in this chapter are therefore presented for four separate age groups: 11 to 15 years, 16 to 24 years, 25 to 49 years and 50 to 64 years (as opposed to the standard NDNS age groups 11 to 18 years and 19 to 64 years) for both Northern Ireland and the UK as a whole to allow comparison between the two samples. Results are also subdivided by sex for these age groups. However, it should be noted that the cell size for males aged 50 to 64 years is small, therefore caution should be taken when interpreting findings for this age/sex group. Further details on the dietary data are given in Chapter 5, section 5.1. The comparisons provided in this chapter are observed differences only. Differences between sub-age groups within Northern Ireland and between Northern Ireland and the UK as a whole have not been tested for statistical significance.

In this chapter, nutrient intakes have been limited to key macronutrients and micronutrients of policy interest and are described from food sources only (not including supplements). The Northern Ireland Cross-Departmental Obesity Prevention Strategy: *A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022*^{1,2} identifies “marker foods”: fruit and vegetables;³ sugary, fizzy drinks and squashes;⁴ confectionery;⁵ chips and other fried foods;⁶ and meat products.⁷ The purpose of the “marker foods” is to monitor those food categories which are of public health interest. Consumption of these marker foods are reported in section 8.6 of this chapter.

Unless stated otherwise, all Dietary Reference Values (DRVs) discussed in this chapter are those presented in the 1991 COMA report on Dietary Reference Values for Food Energy and Nutrients for the United Kingdom.⁸ Chapter 5 presents total energy intakes for standard NDNS age groups compared to the Estimated Average Requirements (EARs), that is, the average of energy requirements for any population group, which have been taken from the 2011 Scientific Advisory Committee on Nutrition (SACN) report on Dietary Reference Values for Energy.⁹ However, no comparisons of total energy intakes to SACN energy EARs⁹ for the sub-age groups presented in this chapter.

Results for food consumption have been limited to vegetables, fruit, meat and fish after disaggregation (i.e. including the contribution from composite dishes containing these ingredients but excluding other components of these dishes)¹⁰ and refer to mean values for the total survey population, including non-consumers.

8.2 Energy and macronutrient intake

This section presents key findings on the daily intakes of energy and macronutrients estimated from the food consumption data. Mean daily intakes of macronutrients are compared with the UK DRVs.^{8,11}

- Mean daily intakes for total and food energy were lowest for males aged 50 to 64 years (1916 kcal total energy) and highest for males aged 16 to 24 years (2269 kcal total energy) with a difference of approximately 350 kcal in both food and total energy between the two sub-age groups. For females, mean daily intake of total energy was similar for all age groups with less than 100 kcal difference between the four sub-age groups; 1570 kcal for females aged 11 to 15 years, 1614 kcal for females aged 16 to 24 years, 1563 kcal for females aged 25 to 49 years and 1580 kcal for females aged 50 to 64 years. There were no clear patterns of difference in mean total and food energy for any age/sex group for Northern Ireland compared with the UK.
- Mean daily intakes of total fat met the DRV of contributing no more than 35% of food energy for all female age groups and for males aged 11 to 15 years. Mean daily intakes of total fat exceeded the DRV for males aged 16 to 24 years, 25 to 49 years and 50 to 64 years. Mean intakes as a percentage of food energy were similar in both the Northern Ireland and the UK samples for those aged 11 to 15 years, but were higher in Northern Ireland than the UK for those aged 16 to 24 years, 25 to 49 years and 50 to 64 years.
- Mean daily intakes of saturated fatty acids exceeded the DRV of providing no more than 11% food energy in all age/sex groups. Mean intakes ranged from 12.5% of food energy in those aged 11 to 15 years to 13.9% in those aged 50 to 64 years in Northern Ireland. Mean intake in males aged 50 to 64 years was higher in Northern Ireland than the UK (14.6% compared with 12.9% food energy respectively).
- Mean *trans* fatty acid intakes met the DRV of providing no more than 2% of food energy in all age/sex groups. Mean intakes as a percentage of food energy were similar in both the Northern Ireland and the UK sample.

- Mean intakes of non-milk extrinsic sugars (NMES) exceeded the DRV of providing no more than 11% of food energy in all age/sex groups, except for males and females aged 50 to 64 years, where intakes were 8.9% and 9.4% of food energy respectively. Mean intakes were highest in the younger sex-combined sub-age groups, ranging from 16.0% for those aged 16 to 24 years and 14.6% for those aged 11 to 15 years.
- Mean NMES intakes as a percentage of food energy were similar or lower for the 11 to 15 years, 25 to 49 years and 50 to 64 years sex-combined sub-age groups in the Northern Ireland sample compared with the UK sample, but higher for the 16 to 24 years sex-combined sub-age group (16.0% compared with 15.0% in the UK).
- Mean daily intakes of non-starch polysaccharide (NSP) increased with age, ranging from 11.2g for those aged 11 to 15 years to 13.6g for those aged 50 to 64 years. Mean intakes did not meet the DRV which is set at a population average intake of 18g per day for adults. Mean intakes were slightly lower in the Northern Ireland sample for all four sex-combined sub-age groups compared with the same groups in the UK sample.

(Tables 8.1a-8.1c)

8.3 Alcohol

This section reports on alcohol intake in grams per day and as a percentage of total energy for both the total Northern Ireland sample (including non-consumers) and for consumers only. Consumers are those who reported consumption of alcoholic beverages in the four-day food diary.¹² Due to limited cell sizes for alcohol consumers aged 16 to 24 years and 50 to 64 years caution should be taken when interpreting findings from these age groups and findings are presented only for sex-combined age groups. It should also be noted that as the cell sizes for alcohol consumers aged 11 to 15 years were under 30, descriptive statistics have not been provided for this age/sex group.

In the Years 1 to 4 combined data, there is a slightly higher proportion of Thursdays, Fridays, Saturdays and Sundays than other days and this should be taken into account when interpreting findings on alcohol intake (see Chapter 5, section 5.1, Table 5A).

On average over the four-day recording period, alcohol provided 9.2% of total energy for Northern Ireland consumers aged 16 to 24 years, 9.1% of energy for consumers aged 25 to 49 years and 8.1% of energy for consumers aged 50 to 64 years.

Alcohol intake at the upper 2.5th percentile provided 29.6% and 31.5% of energy in those aged 25 to 49 years and 50 to 64 years respectively. The proportion of consumers ranged from 37% in those aged 16 to 24 years to 48% in those aged 25 to 49 years. The proportion of alcohol consumers aged 16 to 24 years, 25 to 49 years and 50 to 64 years was lower in Northern Ireland than in the UK for equivalent age groups, however it should be noted that cell sizes for the 16 to 24 years and 50 to 64 years age groups are limited (35 and 48 respectively), therefore caution should be taken when interpreting these findings.

(Tables 8.2a-8.2c)

8.4 Vitamins and minerals

This section presents daily intakes of selected vitamins and minerals for the Northern Ireland sample, namely vitamin D, vitamin C, folate, iron and calcium, from food sources only (excluding dietary supplements) and compares them with the UK Reference Nutrient Intakes (RNIs)¹³ and the proportions of participants with intakes below the Lower Reference Nutrient Intakes (LRNIs)¹⁴ are shown. The RNIs and LRNIs for the vitamins and minerals presented are shown in Tables 5.14 and 5.32 (Chapter 5).

For males, all age groups met or were close to meeting the RNI for the selected vitamins and minerals. Females aged 11 to 15 years had mean intakes below the RNI for iron (59% of the RNI) and calcium (86% of the RNI). Females aged 16 to 24 years had mean intakes below the RNI for iron (55% of the RNI), calcium (89% of the RNI) and folate (84% of the RNI) and females aged 25 to 49 years had mean intakes below the RNI for iron only (61% of the RNI).

For males in all age groups, the proportion with intakes below the LRNI for the selected vitamins and minerals was generally low. Eleven per cent of males aged 16 to 24 years were below the LRNI for iron and 13% of males aged 16 to 24 years were below the LRNI for folate.

A high proportion of females in Northern Ireland had iron intakes below the LRNI (44% for females aged 11 to 15 years; 51% for females aged 16 to 24 years; 36% for females aged 25 to 49 years). For the 16 to 24 years and 25 to 49 years female age groups the proportion with an iron intake below the LRNI was higher in Northern Ireland than in the UK.

For females, 16% of those aged 11 to 15 years, 12% of those aged 16 to 24 years and 9% of the 25 to 49 years age group and 50 to 64 years age group had calcium intakes below the LRNI. The proportion of females with a calcium intake below the LRNI was broadly similar in both Northern Ireland and the UK.

Fourteen per cent of females in Northern Ireland aged 16 to 24 years had intakes below the LRNI for folate. The proportion of females aged 16 to 24 years with a folate intake below the LRNI was higher in Northern Ireland (14%) than the UK (9%), whilst the proportion of females with a folate intake below the LRNI was similar in Northern Ireland and the UK for the other female age groups.

For vitamin D, RNIs are only set for those aged up to four years and those aged 65 years and over, discussion for these age groups can be found in Chapter 5.

(Tables 8.3a-8.5c)

8.5 Vegetables, fruit, meat and fish consumption including from composite dishes

This section reports consumption of vegetables, fruit, meat and fish based on disaggregated data for the Northern Ireland sample. This includes the contribution from composite dishes, but excludes the other components of those dishes.¹⁰ The number of portions of fruit and vegetables consumed per day has also been calculated from the disaggregated data in line with the “5-A-Day” criteria,¹⁵ including up to one portion each of fruit juice and baked beans or pulses per day (see Appendix A).

Erratum note: correction to fruit and vegetable consumption data

Fruit and vegetable consumption figures in this section and section 8.6 have been corrected for an error in the estimation of fruit, vegetables and fruit juice and the calculation of “5-A-Day” portions. Fruit and vegetable components of some food groups (soft drinks, confectionery, biscuits, cakes, sugar, preserves and sweet spreads, savoury snacks and ice cream) were included in the estimates when they should have been excluded. This has now been corrected and the corrected values are slightly lower than the original published values.

Based on disaggregated data, mean total vegetable consumption (not including potatoes) increased with age from 79g per day for those aged 11 to 15 years to 170g per day for those aged 50 to 64 years. Mean total fruit intake (not including juice) was lower in the 11 to 15 and 16 to 24 year age groups (54g and 53g per day respectively) than in the 25 to 49 and 50 to 64 year age groups (73g and 101g per day respectively).

The average number of portions consumed, calculated using the “5-A-Day” criteria¹⁵ increased with age from 2.3 portions per day for those aged 11 to 15 years to 3.8 portions per day for those aged 50 to 64 years. The proportion of participants meeting the “5-A-Day” target increased with age ranging from 4% for those aged 11 to 15 years to 22% for those aged 50 to 64 years. The average number of portions consumed was lower for all age/sex groups in Northern Ireland compared with the UK.

The current recommendation is that, for adults, average intakes of red and processed meat should not exceed 70g per day and the average intake of the very highest consumers of red and processed meat (90g per person per day) should not increase.¹⁶ Mean consumption of red and processed meat based on disaggregated data was lowest in those aged 11 to 15 years (71g per day) and highest in those aged 50 to 64 years (83g per day). While overall mean intakes for females in all age groups met the recommendation, mean intakes for males exceeded it in all age groups with those aged 16 to 24 years having the highest intake of red meat (103g per day). For males, consumption of red meat was higher in Northern Ireland compared with the UK for those aged 11 to 15 years (84g compared with 69g), 16 to 24 years (103g compared with 92g), 25 to 49 years (101g compared with 86g) and 50 to 64 years (96g compared with 82g).

For females consumption of red and processed meat was higher in Northern Ireland compared with the UK, for example for females aged 16 to 24 years (61g compared with 45g).

Mean consumption of oily fish was below the recommendation of one portion (140g) per week¹⁷ in all age groups. On average oily fish consumption was equivalent to 5g per week for those aged 11 to 15 years, 7g per week for those aged 16 to 24 years, 24g per week for those aged 25 to 49 years and 49g per week for those aged 50 to 64 years.¹⁸ Consumption of oily fish was lower in Northern Ireland compared with the UK for those aged 11 to 15 years (equivalent to 5g compared with 11g per week respectively), 16 to 24 years (equivalent to 7g compared with 21g per week respectively), 25 to 49 years (equivalent to 24g compared with 47g per week respectively) and 50 to 64 years (equivalent to 49g compared with 76g per week respectively).

(Tables 8.6 a-c)

8.6 Additional foods: fruit and vegetables; sugary, fizzy drinks and squashes; confectionery; chips and other fried foods; and meat products

This section reports on key foods that are part of a set of “marker foods” (fruit and vegetables;³ sugary, fizzy drinks and squashes;⁴ confectionery;⁵ chips and other fried foods;⁶ and meat products)⁷ set out by the cross-Departmental Obesity Prevention Strategy for Northern Ireland: *A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022* (see section 8.1 for more details).^{1,2} Results are provided for the total Northern Ireland sample, including non-consumers, key findings are presented below.

- Mean fruit and vegetable³ consumption was lower in Northern Ireland than in the UK for all sex/age groups; 133g per day compared with 169g per day for those aged 11 to 15 years, 153g per day compared with 198g per day for those aged 16 to 24 years, 223g per day compared with 271g per day for those aged 25 to 49 years and 272g per day compared with 328g per day for those aged 50 to 64 years.
- Mean consumption of sugary, fizzy drinks and squashes⁴ was higher in Northern Ireland than in the UK for males aged 11 to 15 years (310g per day compared with 277g in the UK), 16 to 24 years (442g per day compared with 317g in the UK) and 25 to 49 years (196g per day compared with 166g in the UK) and lower for males aged 50 to 64 years. Mean consumption of sugary, fizzy drinks and squashes⁴ was slightly lower in Northern

Ireland than in the UK for females aged 11 to 15 years (192g per day compared with 203g in the UK), 25 to 49 years (100g per day compared with 108g in the UK) and 50 to 64 years (49g compared with 55g in the UK) and higher for females aged 16 to 24 years (298g per day compared with 246g per day).

- Consumption of confectionery⁵ for males ranged from 5g per day for those aged 50 to 64 years to 26g per day for those aged 11 to 15 years, however it should be noted that cell sizes for the male 50 to 64 years age groups is limited, therefore caution should be taken when interpreting these findings. For females, consumption was also highest in the 11 to 15 years age group (22g per day) and lowest in females aged 50 to 64 years (7g per day). Consumption of confectionery⁵ was higher in Northern Ireland for males aged 11 to 15 years and females aged 11 to 15 years, 16 to 24 years and 25 to 49 years compared with equivalent age/sex groups in the UK.
- Consumption of chips and other fried foods⁶ for males ranged from 43g per day for those aged 50 to 64 years to 83g per day for those aged 16 to 24 years. For females, consumption was also lowest in the 50 to 64 years age group (28g per day) and highest in females aged 11 to 15 years (55g per day). Consumption of chips and other fried foods⁶ was higher in Northern Ireland for all four age groups for males compared with equivalent age/sex groups in the UK, particularly for males aged 16 to 24 years (83g compared with 61g in the UK), whilst consumption was similar or slightly higher for females in Northern Ireland compared with the UK.
- Mean consumption of meat products⁷ for males ranged from 37g per day for those aged 50 to 64 years to 92g per day for those aged 16 to 24 years. For females, consumption was also lowest in the 50 to 64 years age group (25g per day) and highest in those aged 16 to 24 years (52g per day). Consumption of meat products⁷ was higher in Northern Ireland than in the UK for males (and to a lesser extent females) aged 16 to 24 years and 25 to 49 years and also for males aged 11 to 15 years.

(Tables 8.7 a-c)

¹ The need for a strong evidence base which provides information on the dietary health and nutritional status of the Northern Ireland population has become particularly acute with the cross-Departmental Obesity Prevention Strategy for Northern Ireland: A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022.

² <http://www.dhsspsni.gov.uk/framework-preventing-addressing-overweight-obesity-ni-2012-2022.pdf> (accessed 21/03/14).

³ Total fruit and vegetables – Total disaggregated fruit and vegetables (excluding fruit juice). A full definition is provided in Appendix R of this report.

⁴ Sugary, fizzy drinks and squashes – NDNS food group 57 (soft drinks not diet) All types including squashes and cordials, carbonates. Not 100% fruit juice. Not mineral water (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R). A full definition is provided in Appendix R of this report.

⁵ Confectionery – NDNS food groups 43 (sugar confectionery) and 44 (chocolate confectionery). A full definition is provided in Appendix R of this report.

⁶ Chips and other fried foods – NDNS food groups 38A (chips purchased retail or takeaway. Includes oven and microwave chips), 38C (other purchased potato products fried or baked) and 38D (homemade chips/fried and roast potatoes). A full definition is provided in Appendix R of this report.

⁷ Meat products (including sausages, burgers, meat/chicken pies) – NDNS food groups 29 (burgers - not chicken burgers), 30 (sausages), 31 (meat pies - including chicken pies) and 26A (manufactured coated chicken products). A full definition is provided in Appendix R of this report.

⁸ Report on Health and Social Subjects 41 *Dietary Reference Values (DRVs) for Food Energy and Nutrients for the UK*, Report of the Panel on DRVs of the Committee on Medical Aspects of Food Policy (COMA) 1991. The Stationery Office. London

⁹ Scientific Advisory Committee on Nutrition. Dietary Recommendations for Energy: [Online]. Available http://www.sacn.gov.uk/pdfs/sacn_dietary_reference_values_for_energy.pdf (2011) (accessed 03/03/14).

¹⁰ All composite dishes in the NDNS Nutrient Databank have been disaggregated into their constituent ingredients. This enables the fruit, vegetables, meat and fish in mixed dishes such as stews and pies to be included in consumption figures. The methodology for the disaggregation of composite dishes is provided in Appendix A.

¹¹ For total fat, saturated and *trans* fatty acids and non-milk extrinsic sugars (NMES) the DRVs are the recommended maximum contribution these nutrients should make to the population average diet. For total carbohydrate, *cis*-monounsaturated fatty acids and non-starch polysaccharide (NSP) the DRVs are recommended population averages. For protein, the Reference Nutrient Intakes (RNIs) are set at levels of intake considered likely to be sufficient to meet the requirements of 97.5% of the population.

¹² Consumers also include those who consumed alcohol in recipes and other foods.

¹³ The RNI for a vitamin or mineral is the amount of the nutrient that is sufficient for 97.5% of people in the group. If the average intake of the group is at the RNI, then the risk of deficiency in the group is judged to be very small. However, if the average intake is lower than the RNI then it is possible that some of the group will have an intake below their requirement.

¹⁴ The adequacy of vitamin or mineral intake can be expressed as the proportion of individuals with intakes below the LRNI. The LRNI for a vitamin or mineral is set at the level of intake considered likely to be sufficient to meet the needs of only 2.5% of the population.

¹⁵ [Online]. Available: <http://www.nhs.uk/Livewell/5ADAY/Pages/5ADAYhome.aspx> (accessed 25/04/14).

¹⁶ Scientific Advisory Committee on Nutrition. Iron and Health. London: TSO, 2010

¹⁷ Scientific Advisory Committee on Nutrition. Advice on fish consumption: benefits and risks. London: TSO, 2004

¹⁸ Weekly equivalent oily fish consumption has been calculated using unrounded data rather than the rounded figures in Table 8.6a-c.

9 Comparison of equivalised income quintiles for key nutrients and disaggregated foods

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Erratum note: Correction to fruit and vegetable consumption estimates, including from composite dishes (section 9.2.4 and 9.3.4)

In the first publication of this report (in February 2015), consumption estimates for fruit and vegetables, fruit juice and “5-A-Day” portions, including composite dishes, were incorrectly calculated. Fruit and vegetable components of food groups that should have been excluded (see Appendix A of this report) were mistakenly included. These were: soft drinks, confectionery, biscuits, cakes, sugar, preserves (including jam) and sweet spreads, savoury snacks and ice cream. The results presented in this chapter have been updated to correctly exclude all of the food groups that should be excluded as part of the “5-A-Day” calculations. The corrected values for fruit and vegetable consumption are therefore slightly lower than the values originally published but the overall conclusions are unchanged. Details of the methodology for estimating fruit and vegetable consumption and calculating “5-A-Day” portions can be found in Appendix A.

9.1 Introduction

This chapter presents consumption of selected foods and intake of key nutrients in Years 1 to 4 combined of the NDNS Rolling Programme (RP) by equivalised household income and the Northern Ireland Multiple Deprivation Measure (NIMDM).¹

Results are presented for males and females combined for the standard NDNS age groups; 4 to 10 years, 11 to 18 years and 19 to 64 years, subdivided into tertiles. Results are not presented for these standard age groups split by sex as the number of participants in these age groups was too small to split by sex. The number of participants in Northern Ireland aged 1.5 to 3 years and 65 years and over were too small to be subdivided into tertiles and are therefore not presented in this chapter.

Nutrient intakes presented in this chapter have been limited to key macronutrients and micronutrients of policy interest and are described from food sources only (not including supplements). Unless stated otherwise, all Dietary Reference Values (DRVs) discussed in this chapter are those presented in the 1991 Committee on Medical Aspects of Food Policy (COMA) report on Dietary Reference Values for Food Energy and Nutrients for the United Kingdom.² Results for food consumption include vegetables, fruit, meat and fish after disaggregation (i.e. including the contribution from composite dishes, both homemade dishes and manufactured products, containing these ingredients but excluding other components of these dishes).³

The Northern Ireland Cross-Departmental Obesity Prevention Strategy: *A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022*^{4,5} identifies “marker foods”: fruit and vegetables;⁶ sugary, fizzy drinks and squashes;⁷ confectionery;⁸ chips and other fried foods;⁹ and meat products.¹⁰ The purpose of the “marker foods” is to monitor those food categories which are of public health interest. A definition of all the categories of these foods included in Tables 9.7 and 9.14 is provided in Appendix R of this report. The values in these tables refer to mean values for the total NDNS RP population in Northern Ireland, including non-consumers.

Equivalisation is a standard methodology that adjusts household income to account for different demands on resources by considering the household size and composition.¹¹ Equivalised income tertile 1 is the group with the lowest equivalised household income and equivalised income tertile 3 is the group with the highest equivalised household income.

NIMDM¹ identifies small area concentrations of deprivation across Northern Ireland using a consistent approach. NIMDM is used to inform policy and target areas of need in Northern Ireland. In this chapter, the areas have been split into tertiles, with tertile 1 containing the most deprived areas and tertile 3 containing the least deprived areas.

Statistical analysis has been carried out for this chapter to compare equivalised household income tertiles and NIMDM tertiles to the respective reference group only. The highest income/least deprived group (tertile 3) has been used as the reference group (refer to Appendix Y for a more detailed explanation of the statistical analysis).

This chapter presents a summary of reported intakes across tertiles, highlighting any patterns, for example where there is an increase or decrease across the tertiles. Not all statistically significant differences are described, especially where there is no clear pattern, however all statistically significant differences are annotated in Tables 9.1 to 9.14. For equivalised income, only results for age groups 11 to 18 years and 19 to 64 years are discussed. No statistical analysis has been carried out on children aged 4 to 10 years split by equivalised income as the reference group (tertile 3) in this age group has less than 50 individuals. Numbers are low in some other tertile groups (for example children aged 11 to 18 years in tertile 3 when split by equivalised income); therefore caution should be exercised when interpreting findings. For ease of reading, the term 'equivalised household income tertile' has been abbreviated throughout the chapter to 'income tertile'. In addition, 'statistically significant' has been abbreviated throughout the chapter to 'significant'.

9.2 Comparison of equivalised household income tertiles for key nutrients and disaggregated foods

9.2.1 Energy and key macronutrient intake by equivalised household income

This section presents key findings on the daily intakes of energy and macronutrients estimated from the food consumption data for the different age groups by income tertiles with those in tertile 1 having the lowest income and those in tertile 3 having the highest income. Mean daily intakes of macronutrients are compared with the respective UK DRVs.^{8,12}

- No clear pattern in mean daily intake of total or food energy was observed between income tertiles.
- Total fat intake expressed as a percentage of food energy in children aged 11 to 18 years decreased from the lowest to the highest income tertile and was significantly higher in income tertile 1 (35.0%) compared with income tertile 3 (32.5%). This pattern was not seen in adults aged 19 to 64 years.

- No clear pattern was observed for mean intake of saturated fatty acids as a percentage of food energy or in terms of absolute intakes for any age groups. Mean intake of saturated fatty acids in all income tertiles was above the recommendation of no more than 11% of food energy intake.
- No clear pattern was observed in mean intake of *trans* fatty acids between income tertiles as a percentage of food energy or in terms of absolute intakes (grams per day) in any age group. Mean intakes in all income tertiles and age groups met the recommendation of no more than 2% of food energy intake from *trans* fatty acids.
- No clear pattern was observed in mean protein intake between income tertiles in children aged 11 to 18 years. Adults aged 19 to 64 years in income tertiles 1 (71.1g) and 2 (70.7g) had a mean protein intake that was significantly lower than income tertile 3 (78.8g). In this age group, mean protein intake as a percentage of food energy increased from the lowest to highest income tertile, although the differences were not significant.
- Children aged 11 to 18 years had a mean intake of carbohydrate that increased from the lowest to the highest income tertile both in terms of absolute intake (grams per day) and as a percentage of food energy. In this age group, mean intake expressed in grams and as a percentage of food energy was significantly lower in income tertile 1 (228g and 49.7%) compared with income tertile 3 (255g and 52.0%). No clear pattern was observed in mean intake of total carbohydrate for adults aged 19 to 64 years when split by income tertiles.
- In children aged 11 to 18 years mean intakes of non-milk extrinsic sugars (NMES) expressed in terms of absolute intake (grams per day) increased from the lowest to highest income tertile, although the differences were not significant. There was no pattern by income in intakes as a percentage of food energy. Mean intake of NMES as a percentage of food energy for adults aged 19 to 64 years was significantly higher in the lowest income tertile (14.0%) compared with the highest (11.5%).

- For non-starch polysaccharides (NSP), mean intake was lower in income tertile 1 compared with income tertile 3 for all age groups. These differences reached statistical significance in children aged 11 to 18 years (11.0g compared with 12.6g) and adults aged 19 to 64 years (11.8g compared with 13.9g). Adults in all income tertiles had a mean intake which was below the population average recommendation of 18g per day.

(Table 9.1)

9.2.2 Alcohol intake by equivalised household income

This section reports on alcohol intakes in grams per day and as a percentage of total energy for the total sample (including non-consumers). Numbers were too small to report alcohol intakes by consumers only. In the Year 1 to 4 combined data for Northern Ireland, there were a slightly higher proportion of Thursdays, Fridays, Saturdays and Sundays than any other day, and this should be taken into account when interpreting findings on alcohol intake (see Chapter 5, section 5.1, Table 5A).

For mean alcohol intake in adults aged 19 to 64 years, no clear association with income was observed. In this age group, mean alcohol intake expressed in grams, was significantly higher in income tertile 1 (15.1g) and significantly lower in income tertile 2 (6.9g) compared with income tertile 3 (14.7g). When expressed as a percentage of total energy intake, alcohol was significantly lower in income tertiles 1 (4.6%) and 2 (2.3%) compared with income tertile 3 (5.0%).

(Table 9.2)

9.2.3 Vitamins and minerals by equivalised household income

This section presents daily intakes of selected vitamins and minerals, namely vitamin C, vitamin D, folate, iron and calcium, from foods only (not including supplements). Mean daily intakes of these vitamins and minerals are compared with the UK Reference Nutrient Intakes (RNIs)¹³ and the proportions of participants with intakes below the Lower Reference Nutrient Intakes (LRNIs)¹⁴ are shown. The RNIs and LRNIs for the vitamins and minerals presented are shown in Tables 5.14 and 5.32 (Chapter 5).

- Mean iron intake in children aged 11 to 18 years and adults aged 19 to 64 years increased from the lowest to highest income tertile. In both age groups, the intake was significantly lower in income tertile 1 (8.9mg and 9.3mg respectively) compared with those in income tertile 3 (10.6mg and 11.2mg). In adults aged 19 to 64 years, mean intake in income tertile 2 (9.8mg) was also significantly lower compared with those in income tertile 3 (11.2mg). When expressed as a percentage of the RNI, mean iron intake in children aged 11 to 18 years in all income tertiles fell below 90% of the RNI. Thirty-five percent of children aged 11 to 18 years and 22% of adults aged 19 to 64 years in the lowest income tertile had iron intakes below the LRNI compared with 13% and 7% respectively in the highest income tertile. The difference was significant for the 11 to 18 years age group.
- Mean calcium intake increased from the lowest to highest income tertile in all age groups although the differences were not statistically significant. Children aged 11 to 18 years in income tertile 1 had a mean intake of calcium which fell below 90% of the RNI (86%). There was no clear pattern by income in the percentage with intakes below the LRNI.
- Mean vitamin C intake increased from the lowest income tertile to the highest income tertile in all age groups. Mean vitamin C intake was greater than 100% of the RNI in all income tertiles for all age groups.
- Mean vitamin D intake in the lowest income tertile was significantly lower (2.5µg) than in the highest income tertile (2.9µg) in adults aged 19 to 64 years.
- Mean folate intake was significantly lower in the lowest income tertile compared with the highest income tertile for children aged 11 to 18 years (197µg in income tertile 1; 236µg in income tertile 3) and adults aged 19 to 64 years (224µg in income tertile 1; 259µg in income tertile 3). Mean folate intake was greater than 90% of the RNI in all age groups and income tertiles and no more than 4% of any age group/income tertile had intakes below the LRNI.

(Tables 9.3 – 9.5)

9.2.4 Vegetables, fruit, meat and fish consumption, including from composite dishes by equivalised household income

Erratum note: correction to fruit and vegetable consumption data

Fruit and vegetable consumption figures in this section have been corrected for an error in the estimation of fruit, vegetables and fruit juice and the calculation of “5-A-Day” portions. Fruit and vegetable components of some food groups (soft drinks, confectionery, biscuits, cakes, sugar, preserves and sweet spreads, savoury snacks and ice cream) were included in the estimates when they should have been excluded. This has now been corrected and the corrected values are slightly lower than the original published values.

This section reports consumption of vegetables, fruit, meat and fish based on disaggregated data. This includes the contribution from composite dishes (both homemade dishes and manufactured products), but excludes the other components of those dishes.¹⁰ The number of portions of fruit and vegetables consumed per day has also been calculated from the disaggregated data in line with the “5-A-Day” criteria, including up to one portion each of fruit juice and baked beans or pulses per day (see Appendix A).

- Mean total fruit and vegetable consumption in children aged 11 to 18 years and adults aged 19 to 64 years showed an increase from the lowest to highest income tertile. In these two age groups, mean intake was significantly lower in income tertiles 1 (114g and 172g) and 2 (134g and 228g) compared with income tertile 3 (183g and 267g). In addition for these age groups, mean consumption of “5-A-Day” portions was significantly lower in income tertiles 1 (2.0 and 2.6 portions respectively) and 2 (2.3 and 3.2 portions respectively) compared to income tertile 3 (3.0 and 3.9 portions respectively).
- The percentage achieving “5-A-Day” was low in children aged 11 to 18 years in all income tertiles (4-5%). The proportion of adults aged 19 to 64 years who achieved 5 portions of fruit and vegetables per day increased from the lowest to highest income tertiles (8%, 18% and 23% respectively).
- No clear patterns were seen for mean total meat or mean red meat consumption in any age group when split by income tertiles.

- Mean total fish consumption in adults aged 19 to 64 years was significantly lower in income tertiles 1 (12g) and 2 (11g) compared with income tertile 3 (22g). For this age group, oily fish consumption was also lower in income tertiles 1 (3g) and 2 (2g) compared with income tertile 3 (8g) but did not reach statistical significance.

(Table 9.6)

9.2.5 Average daily consumption of Northern Ireland strategy marker foods by equivalised household income

This section reports on “marker foods” including fruit and vegetables;⁶ sugary, fizzy drinks and squashes;⁷ confectionery;⁸ chips and other fried foods;⁹ and meat products¹⁰ which have been identified in the cross-Departmental Obesity Prevention Strategy for Northern Ireland.⁵ Results are provided for the total NDNS RP population in Northern Ireland, including non-consumers (i.e. those who did not consume from a food group during the four-day recording period).

- Mean consumption of sugary, fizzy drinks and squashes⁷ showed a pattern of decreasing from the lowest to highest income tertile in children aged 11 to 18 years and adults aged 19 to 64 years but did not reach statistical significance.
- Mean consumption of confectionery⁸ in children aged 11 to 18 years was significantly lower in income tertile 1 (19g) compared with income tertile 3 (30g). There was no clear pattern in other age groups.
- Mean consumption of chips and fried foods⁹ in all age groups decreased from income tertile 1 to income tertile 3, particularly in children aged 11 to 18 years and adults aged 19 to 64 years and was significantly higher in children aged 11 to 18 years in income tertiles 1 (69g) and 2 (59g) compared with income tertile 3 (40g).
- Mean consumption of meat products (including sausages, burgers, meat/chicken pies)¹⁰ was significantly higher in children aged 11 to 18 years in income tertiles 1 (59g) and 2 (63g) compared with income tertile 3 (44g). In adults aged 19 to 64 years, mean consumption of meat products (including sausages, burgers, meat/chicken pies)¹⁰ was significantly higher in income tertile 1 (56g) compared with income tertile 3 (44g).

(Table 9.7)

9.3 Comparison of Northern Ireland Multiple Deprivation Measure (NIMDM) tertiles for key nutrients and foods

9.3.1 Energy and key macronutrient intake by NIMDM

This section presents key findings on the daily intakes of energy and macronutrients estimated from the food consumption data for the different age groups by NIMDM tertiles with tertile 1 containing the most deprived areas of Northern Ireland and tertile 3 containing the least deprived areas of Northern Ireland. Mean daily intakes of macronutrients are compared with the respective UK DRVs.⁸

- No clear pattern in mean daily intake of total or food energy was observed between NIMDM tertiles.
- Mean total fat intake expressed as a percentage of food energy in children aged 4 to 10 years and 11 to 18 years in NIMDM tertile 1 were significantly higher (35.4% and 34.9%) than tertile 3 (33.0% and 32.4%).
- No clear pattern was observed in mean intakes of saturated fatty acids as a percentage of food energy or in terms of absolute intake for any age group. Mean intakes of saturated fatty acids in all NIMDM tertiles was above the recommendation of no more than 11% of food energy intake.
- No clear pattern was observed in mean intakes of *trans* fatty acids as a percentage of food energy or in terms of absolute intakes for any age groups. Mean intakes in all age groups and all NIMDM tertiles met the recommendation of no more than 2% of food energy intake from *trans* fatty acids.
- For adults aged 19 to 64 years, mean protein intake in NIMDM tertiles 1 (67.9g) and 2 (72.1g) were significantly lower compared with NIMDM tertile 3 (78.1g). A similar pattern was seen for children although the differences were not significant. No clear patterns were observed when protein intake was expressed as a percentage of food energy intake.

- Mean total carbohydrate intake for children aged 11 to 18 years increased from the most deprived to the least deprived NIMDM tertile and was significantly lower in NIMDM tertile 1 (221g) compared with NIMDM tertile 3 (249g). In children aged 4 to 10 years, carbohydrate intake expressed as a percentage of food energy intake was significantly lower in NIMDM tertile 1 (49.6%) compared with NIMDM tertile 3 (52.2%) and significantly lower in children aged 11 to 18 years in NIMDM tertiles 1 (50.1%) and 2 (50.0%) compared with NIMDM tertile 3 (52.1%). This pattern was not seen in adults.
- Mean intake of non-milk extrinsic sugars (NMES) in adults aged 19 to 64 years expressed as a percentage of food energy intake and absolute terms in grams, was higher in NIMDM tertile 1 (13.7% and 66.1g) compared with NIMDM tertile 2 (11.1% and 53.1g) and NIMDM tertile 3 (11.7% and 59.2g). In children aged 11 to 18 years, mean gram intakes of NMES were lower in NIMDM tertile 1 (64.0g) compared with tertiles 2 (70.9g) and 3 (69.7g) but there was no clear pattern by NIMDM tertile when expressed as a percentage of food energy. The differences were not statistically significant in either age group.
- For non-starch polysaccharides (NSP), mean intake increased from NIMDM tertile 1 to NIMDM tertile 3 for all age groups. In children aged 11 to 18 years and adults aged 19 to 64 years, mean intake of NSP was significantly lower in NIMDM tertile 1 (10.3g and 12.0g) compared with NIMDM tertile 3 (12.1g and 14.2g). Adults in all NIMDM tertiles had a mean intake which was below the population average recommendation of 18g per day.

(Table 9.8)

9.3.2 Alcohol intake by NIMDM

This section reports on alcohol intakes in grams per day and as a percentage of total energy for the total sample (including non-consumers). Numbers were too small to report alcohol intakes by consumers only. In the Years 1 to 4 combined data for Northern Ireland, there are a slightly higher proportion of Thursdays, Fridays, Saturdays and Sundays than any other day, and this should be taken into account when interpreting findings on alcohol intake (see Chapter 5, section 5.1, Table 5A).

Mean alcohol intake in adults aged 19 to 64 years expressed in grams and as a percentage of energy intake were lower in NIMDM tertile 2 (9.5g and 3.1%) compared with NIMDM tertile 1 (16.3g and 5.3%) and NIMDM tertile 3 (12.2g and 4.0%), however, the differences were not statistically significant.

(Table 9.9)

9.3.3 Vitamins and minerals by NIMDM

This section presents daily intakes of selected vitamins and minerals, namely vitamin C, vitamin D, folate, iron and calcium, from foods only (not including supplements). Mean daily intakes of these vitamins and minerals are compared with the UK RNIs¹³ and the proportions of participants with intakes below the LRNIs¹⁴ are shown. The RNIs and LRNIs for the vitamins and minerals presented are shown in Tables 5.14 and 5.32 (Chapter 5).

- Mean iron intake in children aged 11 to 18 years and adults aged 19 to 64 years increased from the most deprived to the least deprived NIMDM tertile. In both age groups, the mean intake was significantly lower in NIMDM tertiles 1 (8.8mg and 9.1mg) and 2 (9.1mg and 9.9mg) compared with NIMDM tertile 3 (10.4mg and 11.1mg). Mean iron intake in children aged 11 to 18 years in all tertiles fell below 90% of the RNI. In children aged 11 to 18 years the proportion below the LRNI was significantly higher for NIMDM tertile 1 (36%) compared with NIMDM tertile 3 (20%). In adults aged 19 to 64 years, 10-20% had intakes below the LRNI with no clear pattern by NIMDM tertile.

- In all age groups there was a clear pattern for mean calcium intake to increase from the most deprived to the least deprived NIMDM tertile. Children aged 11 to 18 years in NIMDM tertile 1 had a mean intake of calcium which fell below 90% of the RNI (82%) this was significantly lower than the mean intake in tertile 3 (95% of the RNI). In children aged 11 to 18 years 8-14% across the NIMDM tertiles had calcium intakes below the LRNI.
- Mean vitamin C intake increased from the most deprived NIMDM tertile to the least deprived NIMDM tertile in all age groups with the exception of children aged 4 to 10 years. Mean vitamin C intake was greater than 100% of the RNI in all NIMDM tertiles for all age groups.
- Vitamin D intake increased from the most deprived to the least deprived NIMDM tertile in adults aged 19 to 64 years. Mean intake in income tertile 1 (2.3µg) was significantly lower than income tertile 3 (2.9µg).
- Mean folate intake was significantly lower for adults aged 19 to 64 years in NIMDM tertiles 1 (217µg) and 2 (226µg) compared to NIMDM tertile 3 (265µg). The same pattern was observed in children aged 4 to 18 years but the differences were not statistically significant.

(Table 9.10 – 9.12)

9.4 Vegetables, fruit, meat and fish consumption, including from composite dishes by NIMDM

Erratum note: correction to fruit and vegetable consumption data

Fruit and vegetable consumption figures in this section have been corrected for an error in the estimation of fruit, vegetables and fruit juice and the calculation of “5-A-Day” portions. Fruit and vegetable components of some food groups (soft drinks, confectionery, biscuits, cakes, sugar, preserves and sweet spreads, savoury snacks and ice cream) were included in the estimates when they should have been excluded. This has now been corrected and the corrected values are slightly lower than the original published values.

This section reports consumption of vegetables, fruit, meat and fish based on disaggregated data. This includes the contribution from composite dishes (both homemade dishes and manufactured products), but excludes the other components of those dishes.¹⁰ The number of portions of fruit and vegetables consumed per day has also been calculated from the disaggregated data in line with the “5-A-Day” criteria, including up to one portion each of fruit juice and baked beans or pulses per day (see Appendix A).

- In children aged 4 to 10 years and 11 to 18 years and adults aged 19 to 64 years, mean total fruit and vegetable consumption was significantly lower in NIMDM tertile 1 (134g, 105g and 204g respectively) compared with NIMDM tertile 3 (176g, 171g and 278g respectively). For children aged 11 to 18 years and adults aged 19 to 64 years consumption in NIMDM tertile 2 (127g and 199g respectively) was also significantly lower than NIMDM tertile 3 (171g and 278g respectively).
- Mean consumption of “5-A-Day” portions for children aged 11 to 18 years and adults aged 19 to 64 years was significantly lower in NIMDM tertiles 1 (1.9 portions per day and 3.0 portions per day) and 2 (2.1 portions per day and 2.9 portions per day) compared with NIMDM tertile 3 (2.8 portions per day and 4.0 portions per day).
- The percentage achieving “5-A-Day” was low in children aged 11 to 18 years in all NIMDM tertiles (3-7%). Between 9% and 26% of adults aged 19 to 64 years achieved 5-a-day but there was no clear pattern related to NIMDM tertile.
- Total meat consumption in children aged 4 to 10 years decreased from the most deprived to the least deprived NIMDM tertile with mean intake in NIMDM tertile 1 (90g) significantly higher than NIMDM tertile 3 (73g). There was no clear pattern in other age groups or for red meat.
- For adults aged 19 to 64 years, mean total fish consumption was significantly lower in NIMDM tertiles 1 (10g) and 2 (12g) compared with NIMDM tertile 3 (22g). For this age group, oily fish consumption was also lower in NIMDM tertiles 1 (2g) and 2 (3g) compared with NIMDM tertile 3 (7g) but was not statistically significant.

(Table 9.13)

9.5 Average daily consumption of Northern Ireland strategy marker foods by NIMDM

This section reports on “marker foods” including fruit and vegetables,⁶ sugary, fizzy drinks and squashes;⁷ confectionery;⁸ chips and other fried foods;⁹ and meat products¹⁰ which have been identified in the cross-Departmental Obesity Prevention Strategy for Northern Ireland.⁵ The values in the Tables 9.7 and 9.14 for these foods refer to mean values for the total NDNS RP population in Northern Ireland, including non-consumers (i.e. those who did not consume from a food group during the four-day recording period).

- Mean consumption of sugary, fizzy drinks and squashes⁷ decreased from the most deprived to the least deprived NIMDM tertile in children aged 11 to 18 years and adults aged 19 to 64 years, but the difference was not statistically significant in either age group.
- No clear pattern was observed for mean consumption of confectionery⁸ when split by NIMDM tertiles.
- In children aged 4 to 10 years and 11 to 18 years and adults aged 19 to 64 years, chips and other fried foods⁹ consumption was significantly higher in NIMDM tertile 1 (54g, 65g and 60g respectively) compared with NIMDM tertile 3 (32g, 46g and 32g respectively).
- Mean consumption of meat products (including sausages, burgers, meat/chicken pies)¹⁰ in children aged 4 to 10 years and 11 to 18 years decreased from the most deprived to the least deprived NIMDM tertile though the difference did not reach significance. In adults aged 19 to 64 years no clear pattern was observed.

(Table 9.14)

9.6 Summary of main findings by equivalised household income and Northern Ireland Multiple Deprivation Measure (NIMDM)

There were some differences observed in food consumption, energy and nutrient intakes by equivalised household income and NIMDM tertiles, particularly for fruit and vegetable consumption. Differences were clearest between the lowest and highest tertiles but were not seen in all age groups.

Overall, there were no clear differences by equivalised household income or NIMDM for energy intake or macronutrients. The exception was NSP intake which was lower in the lowest income/most deprived tertiles in all age groups.

Mean intake of micronutrients tended to be lower in the lower equivalised income tertiles and the most deprived NIMDM tertiles compared with the highest and the least deprived tertiles. The differences reached statistical significance in some age groups. Mean intakes of folate and vitamin C were above the RNI across the income and NIMDM tertiles for both adults and children while mean intakes of iron and calcium were below the RNI for children aged 11 to 18 years across the income and NIMDM tertiles.

Mean fruit and vegetable consumption expressed in grams and as “5-A-Day” portions showed clear differences between tertile 1 and tertile 3 when split by equivalised income and by NIMDM, with some age groups showing a pattern of increasing intake from tertile 1 to tertile 3. However, mean consumption in all tertiles was below the recommendation of “5-A-Day”. No clear pattern for total meat, red meat, total fish or oily fish consumption was observed in any age group. With the exception of fruit and vegetables, consumption of the Northern Ireland “marker foods” tended to be higher in the lower/most deprived tertiles.

¹ The Northern Ireland Multiple Deprivation Measure (NIMDM) 2010 comprises seven domains of deprivation, each developed to measure a distinct form or type of deprivation; income, employment, health, education, proximity to services, living environment and crime. Although the term deprivation is often synonymous with monetary poverty it is important to note that only the Income Deprivation Domain is intended to measure poverty in this sense. The remaining six domains focus on other types of deprivation, such as the lack of adequate education or poor health. The domains can be interpreted individually or combined to assess deprivation in more than one domain. http://www.nisra.gov.uk/deprivation/archive/Updateof2005Measures/NIMDM_2010_Report.pdf.

² Report on Health and Social Subjects 41 *Dietary Reference Values (DRVs) for Food Energy and Nutrients for the UK*, Report of the Panel on DRVs of the Committee on Medical Aspects of Food Policy (COMA) 1991. The Stationery Office. London

³ All composite dishes in the NDNS Nutrient Databank have been disaggregated into their constituent ingredients. This enables the fruit, vegetables, meat and fish in mixed dishes such as stews and pies to be included in consumption figures. The methodology for the disaggregation of composite dishes is provided in Appendix A. Disaggregation has not been carried out for previous surveys.

⁴ <http://www.northernireland.gov.uk/index/media-centre/news-departments/news-dhssps/news-dhssps-151111-health-survey-northern.htm> (accessed 04/02/14)

⁵ A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022.

<http://www.dhsspsni.gov.uk/framework-preventing-addressing-overweight-obesity-ni-2012-2022.pdf> (accessed 21/03/14)

⁶ Total fruit and vegetables – Total disaggregated fruit and vegetables (excluding fruit juice). A full definition is provided in Appendix R of this report.

⁷ Sugary, fizzy drinks and squashes – All types including squashes and cordials, carbonates. Not 100% fruit juice. Not mineral water (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R). A full definition is provided in Appendix R of this report.

⁸ Confectionery – NDNS food groups 43 (sugar confectionery) and 44 (chocolate confectionery). A full definition is provided in Appendix R of this report.

⁹ Chips and other fried foods – NDNS food groups 38A (chips purchased retail or takeaway. Includes oven and microwave chips), 38C (other purchased potato products fried or baked) and 38D (homemade chips/fried and roast potatoes). A full definition is provided in Appendix R of this report.

¹⁰ Meat products (including sausages, burgers, meat/chicken pies) – NDNS food groups 29 (burgers - not chicken burgers), 30 (sausages), 31 (meat pies - including chicken pies) and 26A (manufactured coated chicken products). A full definition is provided in Appendix R of this report.

¹¹ Household income was thus established by means of a card on which banded incomes were presented (see Appendix D). Information was obtained from the household reference person (HRP) or their partner. They were asked to estimate their total household income in the last 12 months, before any deductions for tax, including income from earnings, self-employment, benefits, pensions, and interest from savings.

Equivalent income adjusts income to take account of the number of persons (adults and children) in the household. Equivalent household income was calculated using the McClements scoring system, described below:

A score was allocated to each household member, and these were added together to produce an overall household McClements score:

First adult (HRP)	0.61
Spouse/partner of HRP	0.39
Other second adult	0.46
Third adult	0.42
Subsequent adults	0.36
Dependant aged 0-1	0.09
Dependant aged 2-4	0.18
Dependant aged 5-7	0.21
Dependant aged 8-10	0.23
Dependant aged 11-12	0.25
Dependant aged 13-15	0.27
Dependant aged 16+	0.36

The equivalised income was derived as the annual household income divided by the McClements score. This equivalised annual household income was attributed to all members of the household, including children. Households were ranked by equivalised income, and tertiles t1 – t5 were identified within age groups in the overall sample.

All individuals in each household were allocated to the equivalised household income tertiles to which their household had been allocated.

(Reference:McClements D.Equivalence scales for children. Journal of Public Economics 1977;8:191-210.)

¹² For total fat, saturated and *trans* fatty acids and non-milk extrinsic sugars (NMES) the DRVs are the recommended maximum contribution these nutrients should make to the population average diet. For total carbohydrate, *cis*-monounsaturated fatty acids and non-starch polysaccharide (NSP) the DRVs are recommended population averages. For protein, the Reference Nutrient Intakes (RNIs) are set at levels of intake considered likely to be sufficient to meet the requirements of 97.5% of the population.

¹³ The RNI for a vitamin or mineral is the amount of the nutrient that is sufficient for 97.5% of people in the group. If the average intake of the group is at the RNI, then the risk of deficiency in the group is judged to be very small. However, if the average intake is lower than the RNI then it is possible that some of the group will have an intake below their requirement.

¹⁴ The adequacy of vitamin or mineral intake can be expressed as the proportion of individuals with intakes below the LRNI. The LRNI for a vitamin or mineral is set at the level of intake considered likely to be sufficient to meet the needs of only 2.5% of the population.

10 Comparisons within the NDNS Rolling Programme (RP) and between the RP and previous NDNS surveys

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Erratum note: Correction to fruit and vegetable consumption estimates including from composite dishes (section 10.5 and 10.7.4)

In the first publication of this report (in February 2015), consumption estimates for fruit and vegetables, fruit juice and “5-A-Day” portions, including composite dishes, were incorrectly calculated. Fruit and vegetable components of food groups that should have been excluded (see Appendix A of this report) were mistakenly included. These were: soft drinks, confectionery, biscuits, cakes, sugar, preserves (including jam) and sweet spreads, savoury snacks and ice cream. The results presented in this chapter have been updated to correctly exclude all of the food groups that should be excluded as part of the “5-A-Day” calculations. The corrected values for Years 1-4 are therefore slightly lower than the values originally published but the overall conclusions on fruit and vegetable consumption are unchanged. Details of the methodology for estimating fruit and vegetable consumption and calculating “5-A-Day” portions can be found in Appendix A.

10.1 Introduction

This chapter presents comparisons between the Northern Ireland sample and the whole of the UK sample of the NDNS Rolling Programme (RP) Years 1 to 4 combined.¹ Results are presented by standard age groups: 1.5 to 3 years, 4 to 10 years, 11 to 18 years, 19 to 64 years and 65 years and over and are also subdivided by sex (except for children aged 1.5 to 3 years as intakes in this age group do not tend to vary by sex and adults aged 65 years and over where numbers are insufficient to subdivide by sex). Further details on the dietary data are given in Chapter 5, section 5.1.

Nutrient intakes in this chapter have been limited to key macronutrients and micronutrients of policy interest and are described from food sources only (not including supplements). Unless stated otherwise, all Dietary Reference Values (DRVs) presented in this chapter refer to the 1991 COMA report on Dietary Reference Values for Food Energy and Nutrients for the United Kingdom.² Results for food consumption have been limited to vegetables, fruit, meat and fish after disaggregation (i.e. including the contribution from composite dishes, both homemade dishes and manufactured products, containing these ingredients but excluding other components of these dishes).³

The Northern Ireland Cross-Departmental Obesity Prevention Strategy: *A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022*^{4,5} identifies “marker foods”: fruit and vegetables;⁶ sugary, fizzy drinks and squashes;⁷ confectionery;⁸ chips and other fried foods;⁹ and meat products.¹⁰ The purpose of the “marker foods” is to monitor those food categories which are of public health interest. Consumption of these marker foods are reported in section 10.6 of this chapter. A definition of all the categories of foods included in Tables 10.7a to 10.7c is provided in Appendix R of this report. The values in the tables for these foods refer to mean values for the total NDNS RP population, including non-consumers.

Results were tested for statistical significance and these differences between Northern Ireland and the UK for each age/sex group are highlighted in the tables (refer to Appendix Y for a more detailed explanation of the statistical analysis). Some differences do not reach statistical significance due to small numbers in certain age groups. The following text focuses on statistically significant differences and overall patterns of differences of food consumption and nutrient intakes considered to be of public health interest (rather than all the statistically significant results).

10.2 Energy and macronutrient intake

This section presents daily intakes of energy and macronutrients estimated from the food consumption data.

- For boys and men, no clear differences were observed between Northern Ireland and the UK for mean total and food energy intake. For girls and women, mean total and food energy intake tended to be slightly lower in Northern Ireland compared with the UK but the differences were not statistically significant.
- No clear differences between Northern Ireland and the UK were observed in mean daily gram intake of total fat for any age/sex group. Expressed as a percentage of food energy, mean total fat intake for men aged 19 to 64 years was significantly higher in Northern Ireland (36.5%) compared with the UK (34.8%). Girls aged 4 to 10 years in Northern Ireland also had a significantly higher mean total fat intake as a percentage of energy compared with the same age group in the UK (34.8% versus 33.6%). There were no statistically significant differences for other groups.
- Mean intake of saturated fatty acids as a percentage of food energy was significantly higher in men and women combined aged 19 to 64 years in Northern Ireland (13.1%) compared with the same age group in the UK (12.6%). There was no clear pattern of differences for children. For all age/sex groups in both Northern Ireland and the UK, mean intake of saturated fatty acids was above the recommendation of no more than 11% of food energy from saturated fatty acids.
- Mean *trans* fatty acid intakes were similar in Northern Ireland and the UK, with intakes within the recommendation of no more than 2% of total energy intake from *trans* fatty acids.
- For mean protein intake there were no clear differences between Northern Ireland and the UK in any age/sex group either expressed as gram intakes or percentage food energy.
- Mean intake of total carbohydrate tended to be similar in Northern Ireland and the UK for all age/sex groups. No clear patterns were observed between Northern Ireland and the UK for carbohydrate intake expressed as a percentage of food energy for any age/sex

group with the exception of girls aged 4 to 10 years. For this age group carbohydrate intake as a percentage of food energy was significantly lower in Northern Ireland (50.6%) compared with the same age group in the UK (52.0%).

- Non-milk extrinsic sugars (NMES) intake as a percentage of food energy was significantly lower for girls aged 11 to 18 years in Northern Ireland (13.8%) compared with the same age/sex group in the UK (15.2%). There was no clear pattern across other age groups. With the exception of those aged 65 years and over in Northern Ireland, all age/sex groups in Northern Ireland and the UK had NMES intakes that exceeded the recommendation of no more than 11% of food energy.
- Mean non-starch polysaccharides (NSP) intake tended to be lower in all age/sex groups in Northern Ireland compared with the UK. NSP intake was significantly lower in boys aged 4 to 10 years (10.1g compared with 11.5g), girls aged 4 to 10 years (9.7g compared with 10.7g) and men aged 19 to 64 years (13.7g compared with 14.7g). In both Northern Ireland and the UK, mean NSP intake fell below the adult population average recommendation of at least 18g per day.

(Tables 10.1a-10.1c)

10.3 Alcohol

This section reports on alcohol intake in grams per day and as a percentage of total energy for both the total sample (including non-consumers) and for consumers only (those who reported consumption of alcoholic beverages in the four-day diary).¹¹ In the Years 1 to 4 combined data, for both the UK sample and the Northern Ireland sample, there are a slightly higher proportion of Thursdays, Fridays, Saturdays and Sundays than other days and this should be taken into account when interpreting findings on alcohol intake (see section 5.1, Table 5A).

Male consumers aged 19 to 64 years in Northern Ireland had a higher mean intake of alcohol compared with the same age group in the UK but the difference was not statistically significant. For female consumers aged 19 to 64 years, those in Northern Ireland had a lower mean alcohol intake compared with the UK, although the difference was less marked than in men.

There was a lower percentage of alcohol consumers in Northern Ireland compared with the UK overall for both men and women.

(Table 10.2a-10.2c)

10.4 Vitamins and minerals

This section presents daily intakes of selected vitamins and minerals: iron, calcium, vitamin C, folate and vitamin D, from foods only (excluding dietary supplements). Mean daily intakes of these vitamins and minerals are compared with the UK Reference Nutrient Intakes (RNIs)¹² and the proportions of participants with intakes below the Lower Reference Nutrient Intakes (LRNIs)¹³ are provided. The RNIs and LRNIs for the vitamins and minerals presented are shown in Tables 5.14 and 5.32 (Chapter 5).

- For children aged 1.5 to 3 years, boys aged 4 to 18 years and girls aged 11 to 18 years, mean daily iron intake was similar in Northern Ireland and the UK as a whole. Girls aged 4 to 10 years, men and women aged 19 to 64 years and adults aged 65 years and over had a significantly lower mean iron intake in Northern Ireland (7.6mg, 11.0mg, 9.1mg and 9.4mg respectively) compared with the same age groups in the UK (8.4mg, 11.7mg, 9.6mg and 10.2mg respectively). All male age groups had a mean intake above 90% of the RNI. For girls aged 11 to 18 years and women aged 19 to 64 years, mean iron intake in both Northern Ireland and the UK fell below the RNI. For girls aged 11 to 18 years, 50% in Northern Ireland and 46% in the UK had intakes which fell below the LRNI. For women aged 19 to 64 years, 27% in Northern Ireland and 23% in the UK had intakes which fell below the LRNI.
- There were no statistically significant differences in mean calcium intake between Northern Ireland and the UK in any age/sex group. Mean intake was above 90% of the RNI in all age/sex groups with the exception of girls aged 11 to 18 years where mean intake was 85% of the RNI in Northern Ireland and 84% of the RNI in the UK. For girls aged 11 to 18 years 16% in Northern Ireland and 19% in the UK had intakes which fell below the LRNI.
- Mean intake of vitamin C was slightly lower in all age/sex groups in Northern Ireland compared with the UK. They were significantly lower in total girls 4 to 18 years (70.0mg compared with 78.5mg), men aged 19 to 64 years (71.5mg compared with 84.3mg) and

women aged 19 to 64 years (67.4mg compared with 81.6mg). Mean vitamin C intake was above the RNI in both Northern Ireland and the UK for all age/sex groups.

- Mean intake of folate tended to be lower in all age/sex groups in Northern Ireland compared with the UK. They were significantly lower in girls aged 4 to 10 years (174µg compared with 188µg), men aged 19 to 64 years (264µg compared with 287µg) and women aged 19 to 64 years (210µg compared with 228µg). Mean intake was above 90% of the RNI in all age/sex groups. For girls aged 11 to 18 years 7% in Northern Ireland and 8% in the UK had intakes which fell below the LRNI.
- Mean dietary intakes of vitamin D were similar in all age/sex groups in Northern Ireland and the UK. The exception was women aged 19 to 64 years where mean intake was significantly lower in Northern Ireland (2.3µg) compared with the UK (2.6µg). In Northern Ireland and the UK, children aged 1.5 to 3 years and older adults aged 65 years and over had a mean intake of vitamin D which fell below the RNI of 7µg per day and 10µg per day respectively. In children aged 1.5 to 3 years the mean intake as a proportion of the RNI was 25% and 27% respectively and in older adults aged 65 years and over 36% and 33% respectively.

(Tables 10.3a-10.5c)

10.5 Vegetables, fruit, meat and fish consumption, including from composite dishes

Erratum note: correction to fruit and vegetable consumption data

Fruit and vegetable consumption figures in this section and sections 10.6 and 10.7 have been corrected for an error in the estimation of fruit, vegetables and fruit juice and the calculation of “5-A-Day” portions. Fruit and vegetable components of some food groups (soft drinks, confectionery, biscuits, cakes, sugar, preserves and sweet spreads, savoury snacks and ice cream) were included in the estimates when they should have been excluded. This has now been corrected and the corrected values are slightly lower than the original published values. This section reports consumption of vegetables, fruit, meat and fish based on disaggregated data. This includes the contribution from composite dishes (both homemade dishes and manufactured products), but excludes the other components of those dishes.³

The number of portions of fruit and vegetables consumed per day has also been calculated from the disaggregated data in line with the “5-A-Day” criteria, including up to one portion each of fruit juice and baked beans or pulses per day (see Appendix A).

- Overall total mean daily fruit consumption was lower in Northern Ireland compared with the UK in all age/sex groups and was significantly lower in girls aged 4 to 10 years (88g compared with 110g) and men aged 19 to 64 years (68g compared with 94g).
- Total mean daily vegetable consumption in all age/sex groups was significantly lower in Northern Ireland compared with the UK.
- All age/sex groups in Northern Ireland, where the “5-A-Day” criteria can be applied (see Appendix A), had a significantly lower mean consumption of portions of fruit and vegetables compared with the UK. For example 3.1 portions for men aged 19 to 64 years in Northern Ireland compared to 4.0 portions in the UK. The percentage of the population achieving “5-A-Day” was also significantly lower in Northern Ireland in all age/sex groups compared with the UK except for girls aged 11 to 18 years where the difference did not reach statistical significance.
- Mean red and processed meat consumption was higher in Northern Ireland compared with the UK in all age/sex groups, and reached statistical significance in all age/sex groups except for adults aged 65 years and over. For example men aged 19 to 64 years in Northern Ireland had a mean intake of 101g per day compared to 86g per day in the UK as a whole.
- Mean oily fish consumption was lower in all age/sex groups in Northern Ireland compared with the UK; however, oily fish consumption was very low in both Northern Ireland and the UK.

(Tables 10.6a–10.6c)

10.6 Additional foods: sugar sweetened beverages, confectionery, chips and other fried foods, meat products (including sausages, burgers, meat/chicken pies)

This section reports on key foods that are part of a set of “marker foods” (fruit and vegetables;³ sugary, fizzy drinks and squashes;⁴ confectionery;⁵ chips and other fried foods;⁶ and meat products)⁷ set out by the cross-Departmental Obesity Prevention Strategy for Northern Ireland: *A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022*.^{1,2} Results are provided for the total Northern Ireland sample, including non-consumers, key findings are presented below.

- Mean consumption of total fruit and vegetables (excluding fruit juice) was significantly lower in Northern Ireland than in the UK as a whole for all age/sex groups, for example in men aged 19 to 64 years mean consumption in Northern Ireland was 213g compared with 276g in the UK as a whole.
- There were no significant differences between mean consumption of sugary, fizzy drinks and squashes⁴ in Northern Ireland and the UK as a whole for any age/sex group.
- Mean consumption of confectionery⁵ was significantly higher in Northern Ireland than in the UK in children aged 1.5 to 3 years (13g compared with 9g) and in women aged 19 to 64 years (12g compared with 9g). No clear differences were seen in other age/sex groups.
- Mean consumption of chips and other fried foods⁶ was significantly higher in Northern Ireland than in the UK in girls aged 4 to 10 years (46g compared with 35g) and in children aged 11 to 18 years (61g compared with 54g).
- Mean consumption of meat products (including sausages, burgers, meat/chicken pies)⁷ was higher in Northern Ireland than in the UK in all age/sex groups, with the exception of adults aged 65 years and over. The higher consumption in Northern Ireland was significant in children aged 1.5 to 3 years (34g compared with 23g in the UK), girls aged 4 to 10 years (42g compared with 33g), boys aged 11 to 18 years (73g compared with 59g in the UK), men aged 19 to 64 years (63g compared with 48g) and women aged 19 to 64 years (35g compared with 26g in the UK).

(Tables 10.7a-10.7c)

10.7 Comparisons between the Northern Ireland sample of the NDNS RP (2008/09-2011/12) and the Irish National Adult Nutrition Survey (NANS) (2011)

In this section headline comparisons have been made with the Northern Ireland sample of the NDNS RP and the most recent Irish National Adult Nutrition Survey (NANS) (2011).¹⁴ NANS covers the Republic of Ireland only and does not include Northern Ireland. No statistical comparisons have been carried out in this section; the following are observed differences only. In addition, it is important to note that there are also methodological differences in the way in which the NDNS RP and NANS have been carried out. In NANS food intake was determined using a four-day semi-weighed food record, whereas in the NDNS RP food intake was assessed using a four-day estimated diary.¹⁵ In addition, the age range for adults is slightly different in the two surveys: 18 to 64 years in NANS and 19 to 64 years in the NDNS RP. Therefore comparisons should be interpreted with caution.

10.7.1 Energy and Macronutrients

Men in NANS had a mean energy intake of 2397 kcal compared with a mean intake of 2108 kcal in men in the NDNS RP. Women in NANS had a mean energy intake of 1725 kcal compared with 1581 kcal in women in the NDNS RP.

For men in NANS, total fat intake provided 37.1% and carbohydrate intake 45.0% of food energy, compared with 36.5% and 46.7% respectively in men in the NDNS RP. For women in NANS, total fat provided 36.8% and carbohydrate provided 45.8% of food energy compared with 34.6% and 47.9% respectively in women in the NDNS RP.

Mean dietary fibre intake for men in NANS was 15.5g¹⁶ compared with 13.7g for men in the NDNS RP. For women, dietary fibre intake was 12.8g¹⁶ and 12.2g for NANS and the NDNS RP respectively.

10.7.2 Alcohol

In NANS 63% of men and 62% of women reported alcohol consumption during the four-day recording period; this is compared to 50% and 41% respectively in the NDNS RP.

10.7.3 Vitamins and minerals

Vitamin and mineral intakes reported are from food sources only. In NANS, men had a mean iron intake of 14.1mg per day compared with 11.0mg per day in men in the NDNS RP. For women, mean iron intake was 10.5mg in NANS compared with 9.1mg in the NDNS RP.

Mean calcium intake in men was 1043mg in NANS compared with 857mg per day in the NDNS RP. For women, mean calcium intake was 776mg per day in NANS and 712mg in the NDNS RP.

Mean vitamin C intake in men was 81mg per day in NANS compared with 71.6mg in the NDNS RP. In women, mean vitamin C intake was 79mg per day in NANS compared with 67.4mg in the NDNS RP.

Mean folate intake for men was 374µg per day in NANS compared with 264µg per day in the NDNS RP. Mean folate intake for women was 266µg per day in NANS and 210µg per day in the NDNS RP.

10.7.4 Fruit and vegetables

Mean fruit and vegetable consumption in NANS was compared to the NDNS RP.¹⁷ In NANS, mean fruit and vegetable consumption was 249g per day for men and 261g per day for women compared with 213g per day for men and 242g in women in the NDNS RP.

In summary, NANS showed a consistently higher reported intake of energy and selected nutrients and foods compared to the Northern Ireland adult sample of the NDNS RP. However, it is not possible to say with certainty to what extent the observed differences are real and to what extent they may be due to methodological differences between the surveys, for example in the dietary assessment method, the underlying food composition data and coding frame.

¹ The NDNS RP Northern Ireland sample includes core and boost participants. The NDNS RP UK sample also includes the core and boost participants from Northern Ireland. In the UK data, the Northern Ireland cases were weighted down to represent the proportion of participants that the Northern Ireland core participants represent in the NDNS RP UK survey population.

² Report on Health and Social Subjects 41 *Dietary Reference Values (DRVs) for Food Energy and Nutrients for the UK*, Report of the Panel on DRVs of the Committee on Medical Aspects of Food Policy (COMA) 1991. The Stationery Office. London

³ All composite dishes in the NDNS Nutrient Databank have been disaggregated into their constituent ingredients. This enables the fruit, vegetables, meat and fish in mixed dishes such as stews and pies to be included in consumption figures. The methodology for the disaggregation of composite dishes is provided in Appendix A. Disaggregation has not been carried out for previous surveys.

⁴ The need for a strong evidence base which provides information on the dietary health and nutritional status of the Northern Ireland population has become particularly acute with the cross-Departmental Obesity Prevention Strategy for Northern Ireland: A Fitter Future for All – A Framework for Preventing and Addressing Overweight and Obesity in Northern Ireland 2012-2022.

⁵ <http://www.dhsspsni.gov.uk/framework-preventing-addressing-overweight-obesity-ni-2012-2022.pdf> (accessed 21/03/14).

⁶ Total fruit and vegetables – Total disaggregated fruit and vegetables (excluding fruit juice). A full definition is provided in Appendix R of this report.

⁷ Sugary, fizzy drinks and squashes – NDNS food group 57 (soft drinks not diet) All types including squashes and cordials, carbonates. Not 100% fruit juice. Not mineral water (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R). A full definition is provided in Appendix R of this report.

⁸ Confectionery – NDNS food groups 43 (sugar confectionery) and 44 (chocolate confectionery). A full definition is provided in Appendix R of this report.

⁹ Chips and other fried foods – NDNS food groups 38A (chips purchased retail or takeaway. Includes oven and microwave chips), 38C (other purchased potato products fried or baked) and 38D (homemade chips/fried and roast potatoes). A full definition is provided in Appendix R of this report.

¹⁰ Meat products (including sausages, burgers, meat/chicken pies) – NDNS food groups 29 (burgers - not chicken burgers), 30 (sausages), 31 (meat pies - including chicken pies) and 26A (manufactured coated chicken products). A full definition is provided in Appendix R of this report.

¹¹ Consumers also include those who consumed alcohol in recipes and other foods.

¹² The Reference Nutrient Intake (RNI) for a vitamin or mineral is the amount of the nutrient that is sufficient for 97.5% of people in the group. If the average intake of the group is at the RNI, then the risk of deficiency in the group is judged to be very small. However, if the average intake is lower than the RNI then it is possible that some of the group will have an intake below their requirement.

¹³ The adequacy of vitamin or mineral intake can be expressed as the proportion of individuals with intakes below the Lower Reference Nutrient Intake (LRNI). The LRNI for a vitamin or mineral is set at the level of intake considered likely to be sufficient to meet the needs of only 2.5% of the population.

¹⁴ The Irish National Adult Nutrition Survey, (2011) was carried out by the Irish Universities Nutrition Alliance. This survey investigated habitual food and beverage consumption, lifestyle, health indicators and attitudes to food and health in a representative sample (n=1500) of adults aged 18 years and over in the Republic of Ireland during 2008-2010. A sample of 1500 adults (men 740, women 760) aged between 18 and 90 years from across the

Republic of Ireland took part in the National Adult Nutrition Survey (NANS). Individuals were selected for participation from the Data Ireland (An Post) database of free-living adults in Ireland. Each individual who was selected was contacted by mail and followed up shortly afterwards with a visit from a researcher. Eligible persons (adults aged 18 years and over, excluding women who were pregnant or breast-feeding) were invited to participate and a consent form was signed.

15 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 participant'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.

16 It should be noted that the fibre figures provided in this report for NANS are for NSP and are not the figures presented in the NANS survey report, which reported AOAC fibre values. The NANS NSP figures are presented in: Bannon S (2011) National Food Consumption Surveys of Children, Teenagers and Adults in Ireland; Dietary Fibre. PhD thesis, University College Cork, Cork.

¹⁷ Food groups 28 to 39 inclusive were used (tables 2.3 and 2.4) in NANS to derive an average fruit and vegetable intake to compare with the NDNS RP.