National Diet and Nutrition Survey Rolling Programme (NDNS RP)
Results from Years 1-4 (combined) for Scotland (2008/09-2011/12)

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

Edited by: Beverley Bates, Alison Lennox, Ann Prentice, Chris Bates, Polly Page, Sonja Nicholson, Anne Milne and Gillian Swan

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 Scotland 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.

Contents

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 September 2014) 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] The most recent UK report covering Years 1 to 4 (2008/9 to 2011/12) was released as an Official Statistic by PHE on 14th May 2014.[3]

FSA in Scotland (FSAS) has responsibility for monitoring the diet of the population in Scotland and has funded additional recruitment for Years 1 to 4 (2008/9 to 2011/12) in order to enable comparisons to be made with UK results.[4] Increased sample sizes were similarly funded in Wales and Northern Ireland by government bodies in those countries. Results for Northern Ireland and Wales will be published as separate reports later in 2014/15.

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.[5] This report covers a range of topics including food consumption, use of dietary supplements, intakes of energy, macronutrients, vitamins, minerals, salt, and biochemical measures of nutritional status. This report includes information on Body Mass Index (BMI), blood pressure, blood cholesterol levels and the socio-demographic characteristics of the participants.

The combined results from Years 1 to 4 (2008/09 – 2011/12) is the first time representative data from NDNS RP has been available for Scotland. The results will support work by FSAS and the Scottish Government to facilitate improvements to the diet and nutritional status of children and adults in Scotland. The Scottish Government and FSAS voluntary framework for *Supporting Healthy Choices*[6] sets out the action

required to shape and better support healthier diets in Scotland. The framework is underpinned by the National Food and Drink Policy, *Recipe for Success*,[7] and the *Preventing Overweight and Obesity Route Map*.[8] The next stage of the National Food and Drink Policy, *Becoming a Good Food Nation*,[9] has just been launched and health remains a key focus.

The Scottish Dietary Goals (SDGs)[10] revised in 2013, underpin diet and health policy in Scotland and set out the key outcomes required for the Scottish population. The SDGs encompass foods (fruit and vegetables, red meat, oil rich fish) and nutrients (total fat, saturated fatty acids, *trans* fatty acids, non-milk extrinsic sugars (NMES), non-starch polysaccharides (NSP) and salt intakes). Progress towards the SDGs is monitored using a combination of surveys, but principally from secondary analysis of the Living Costs and Food Survey (LCF).[11] The sample size for the NDNS RP in Scotland is too small to analyse trends over time and there is no previous NDNS dataset in Scotland that is large enough for comparison.

In order to reduce population energy intake in Scotland as part of the *Preventing Obesity Route Map Action Plan*,[12] specific foods and drinks high in fat and/or high in sugar have been targeted for population level reduction. This report provides an overview of consumption of these categories by population age/sex groups.

Contents of this report

This report presents combined results from Years 1 to 4 of the NDNS RP for the Scotland sample, which is designed to be nationally representative. It follows the same general format as the UK report published by PHE on 14th May 2014[3] including:

- Background and Purpose (Chapter 1).

- Methodology and Response (Chapter 2).

- Socio-demographic characteristics (Chapter 3).

- Physical measurements and physical activity (Chapter 4).

- Types and quantities of foods consumed based on food groups and composite dishes as eaten (Chapter 5).

- Intakes of energy, macronutrients such as saturated fatty acids, *trans* fatty acids and sugar and alcohol; comparison of energy and nutrient intakes with SDGs[10] and UK Dietary Reference Values (DRVs).[13] Intakes of micronutrients such as iron, calcium, folate and vitamin C, including and excluding the contribution from dietary supplements; comparison of intakes with UK DRVs[13] (Chapter 5).

- Indicators of longer term status for micronutrients from blood analytes and blood lipid concentrations (Chapter 6).

- Salt intakes estimated from urinary sodium excretion (Chapter 7).

- Intakes of key foods and nutrients selected from the SDGs[10] and UK DRVs[13] in Scotland compared with the UK, presented by narrower age bands (Chapter 8).

- Comparison of intakes of key foods and nutrients by household income quintile and Scottish Index of Multiple Deprivation (SIMD) (Chapter 9).

- Statistical comparisons between Scotland and the UK for intakes of key foods and nutrients (Chapter 10).

Overview of key findings

Mean intakes of foods and nutrients
- In the Scotland population, mean saturated fatty acids, non-milk extrinsic sugars (NMES), and salt intakes were above dietary recommendations and the mean intakes of fruit and vegetables, non-starch polysaccharides (NSP; a measure of fibre) and oil-rich fish[14] were below recommendations. Overall the mean total fat and *trans* fatty acids intakes were in line with recommendations.

- Comparisons between Scotland and the UK for key foods and nutrients showed that mean intakes were similar with a few exceptions: mean consumption of vegetables was significantly lower in Scotland than the UK for nearly all age/sex groups; the mean number of "5-A-Day" fruit and vegetable portions was significantly lower in adults aged 19 to 64 years in Scotland compared with the UK (3.7 and 4.0 respectively); mean NSP intake was significantly lower in Scotland than the UK for children aged 4 to 10 years (10.5g and 11.1g respectively) and adults aged 19 to 64 years (13.0g and 13.7g respectively).

Mean intakes of vitamins and minerals
- Mean intakes of most vitamins from food sources were close to or above the Reference Nutrient Intake (RNI)[13,15] for all age/sex groups in Scotland except for vitamin D which was below the RNI for children aged 1.5 to 3 years and for adults aged 65 years and over[13,16] and folate which was below the RNI for girls aged 11 to 18 years.

- There was evidence of low intakes (below the Lower Reference Nutrient Intake (LRNI))[17] of most minerals for some age/sex groups including iron, calcium, magnesium, potassium, zinc, selenium and iodine. Iron intake was

below the LRNI for 54% of girls aged 11 to 18 years and 24% of women aged 19 to 64 years.

- Mean intakes of iron, calcium, vitamin C, folate and vitamin D were compared between Scotland and the UK and no consistent differences in intakes were observed with the exception of folate intake which was significantly lower for adults in Scotland compared with the UK.

Blood measures of nutritional status
- There was little evidence of low status (as measured by concentrations in blood) for most vitamins apart from vitamin D and riboflavin. Mean values for thiamin status as indicated by Erythrocyte Transketolase Activation Coefficient (ETKAC), vitamin C, B$_{12}$, retinol (vitamin A) and vitamin E fell within the reference ranges and the proportion falling outside established thresholds of adequacy was low.

- There was evidence of low biochemical riboflavin status as indicated by Erythrocyte Glutathione Reductase Activation Coefficient (EGRAC) above the currently accepted threshold for biochemical riboflavin repletion. However there is some uncertainty as to the relevance of this threshold to health outcomes.

- There was evidence of low vitamin D status in a proportion of participants in all reported age/sex groups in Scotland, which was similar to the UK. For children aged 11 to 18 years and adults aged 19 to 64 years and 65 years and over, 26.1%, 32.5% and 29.4% respectively had a 25-hydroxyvitamin D (25-OHD) concentration below the current threshold indicating vitamin D adequacy (25nmol/L). A higher proportion of adults, older adults and boys aged 11 to 18 years in Scotland had low vitamin D status compared with the UK.

- There was evidence of iron-deficiency anaemia (as indicated by low haemoglobin concentrations) plus low iron stores (plasma ferritin) in a proportion of girls aged 11 to 18 years (3.1%), women aged 19 to 64 years (3.0%) and women aged 65 years and over (5.2%) in Scotland. These proportions were similar to those in the UK. Mean concentrations of haemoglobin and plasma ferritin were also similar in Scotland compared with the UK.

Urinary sodium analysis for estimated salt intake
- Mean salt intakes for all age groups in Scotland exceeded the recommended maximum intakes[18] except for women aged 65 years and over (by standard criteria only).[19] Mean intake in Scotland for children aged

7 to 10 years and 11 to 18 years was 5.1g per day and 7.1g per day respectively. Mean salt intake for adults aged 19 to 64 years and 65 years and over was 8.6g per day and 7.6g per day respectively. The mean salt intake for adults aged 19 to 64 years in Scotland was similar to that for adults in England (from a 2011 survey of adults),[20] and mean salt intakes for children and older adults were similar to the same age groups in the UK (from UK NDNS RP).

Diets of children and young people

- Children aged 11 to 18 years had the poorest diets; consuming the fewest portions of fruit and vegetables and the highest percentage of food energy from NMES. A substantial proportion of girls in this age group also fell below the LRNI for intakes of some vitamins and most minerals, including folate, vitamin A, riboflavin and iron.

Dietary Inequalities

- There were some differences in food consumption, energy and nutrient intakes by equivalised household income and by Scottish Index of Multiple Deprivation (SIMD) although differences were not consistently observed for all age groups. For adults aged 19 to 64 years there was a pattern of decreased consumption of both fruit and vegetables, increased consumption of 'soft drinks, non-diet',[21] decreased NSP intake and increased percentage of energy from NMES with lower income and higher deprivation. For children aged 11 to 18 years, the pattern was similar with the exception of fruit consumption and percentage of energy from NMES which was not statistically significant.

Sample and response rates

A random sample of 5,832 addresses from 216 postcode sectors, drawn from the Postcode Address File, was issued in Scotland between April 2008 and March 2011. 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.[22] 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.

In Scotland, the response rate for completion of the diary was 53% for Years 1 to 4 combined. A total of 1,695 individuals aged 1.5 years and older completed at least three days of the food and drink diary (867 adults aged 19 years and over and 828 children aged 1.5 to 18 years).[23] Fewer participants agreed to be visited by a nurse and a further percentage declined to give a blood or a 24-hour urine sample.[24] Overall in Years 1 to 4 combined, 51% of adults (440) and 27% of children (227) in Scotland who had completed a diary went on to give a blood sample. Fifty-nine per cent of adults (515) and 47% of children aged 4 to 18 years (391) who completed a diary provided 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.[25] Details of the sampling and methods of analyses can be found in Chapter 2 and Appendix B of this report.

Current diet and nutrition recommendations and nutritional status thresholds

The SDGs[10] relate to the current UK recommendations for food and nutrient intakes.[13] In this report, mean daily intakes of energy and macronutrients are compared with the SDGs and UK DRVs.[26] For total fat, saturated and *trans* fatty acids and NMES the recommendations are the maximum contribution these nutrients should make to the population average diet.[27] These recommendations 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.

Population adequacy of micronutrient intake is assessed by comparing intake with the age and sex specific UK DRV for each vitamin and mineral.[13] Mean intake is compared with the Reference Nutrient Intake (RNI)[15] and an estimate is made of the proportion with intake below the Lower Reference Nutrient Intake (LRNI).[13,17] The RNI and LRNI for each vitamin and mineral are given in Tables 5.14 and 5.32 of this report. In addition, Tables 6.1-6.5 of this report present comparisons of biochemical indices of micronutrient status 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.

Salt intake has been estimated from urinary sodium excretion. Table 1.7 (see section on salt intake) presents the RNIs for sodium, set in 1991 by the Committee on Medical Aspects of Food and Nutrition Policy (COMA) Panel on Dietary Reference Values[13] for the different NDNS age groups covered in the report. The table also shows the

corresponding recommended maximum salt intake per day for adults, which was set by COMA[28] 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.[29]

Physical measures

Table 1.1 provides a summary of the key physical measures for adults and children in Scotland compared with the UK for NDNS RP Years 1 to 4 combined (2008/9 to 2011/12). Measurements were similar to the UK NDNS RP. Measures are also broadly similar to the equivalent Scottish Health Survey data from 2010/11[30] for mean BMI, childhood obesity, raised waist circumference and hypertension.

Table 1.1 Physical measures: NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined		
	NDNS RP Scotland (2008/9 to 2011/12)	NDNS RP UK (2008/9 to 2011/12)[3]
Mean BMI (kg/m^2) ^{a}		
Men (19 years and over)	27.7	27.6
Women (19 years and over)	27.8	27.4
Adult obesity (% obese)^a		
Men (19 years and over)	27%	26%
Women (19 years and over)	29%	29%
Childhood obesity (% obese) ^{b}		
Boys (2 to 18 years)	19%	17%
Girls (2 to 18 years)	16%	19%
Proportion with raised waist circumference		
Men (19 years and over)	34%	37%
Women (19 years and over)	50%	46%
Proportion with hypertension		
Men (19 years and over)	34%	32%
Women (19 years and over)	31%	28%
Proportion of adults aged 19-64 years with raised cholesterol		
5.2 and 6.4mmol/litre	36.1%	34.8%
6.4 and 7.8mmol/litre	8.5%	11.1%
above 7.8mmol/l	1.4%	1.8%
Physical Activity		
Median time spent in moderate or vigorous physical activities		
Men (16 years and over)	1.2 hrs per day	1.0 hrs per day
Women (16 years and over)	0.5 hrs per day	0.5 hrs per day
ActiGraph median counts per minute (CPM)		
Boys (4 to 15 years)	552 CPM	534 CPM
Girls (4 to 15 years)	468 CPM	452 CPM

Bases (unweighted)		
Men BMI	329	1324
Men waist measurement	263	1058
Boys BMI	380	1540
Men hypertension	205	814
Adults raised cholesterol	327	1349
Men physical activity	312	1253
Boys physical activity	94	451
Women BMI	484	1854
Women waist measurement	370	1455
Girls BMI	374	1512
Women hypertension	298	1155
Women physical activity	439	1688
Girls physical activity	118	486

[a] An adult was classified as: underweight if BMI was less than 18.5kg/m^2; normal weight if BMI was from 18.5 to less than 25kg/m^2; overweight if BMI was from 25 to less than 30kg/m^2; obese, excluding morbidly obese, if BMI was from 30 to less than 40kg/m^2; morbidly obese if BMI was 40kg/m^2 or more; overweight, including obese if BMI was 25kg/m2 or more; and as obese if BMI was 30kg/m2 or more.
[b] A child was classified as obese if BMI was >95th centile for sex and age.

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.

A summary of the intakes of selected foods and macronutrients in Scotland and a comparison with the UK are provided in Tables 1.2 and 1.3.

Table 1.2 Average daily intake of selected foods, for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, by age

| | NDNS RP survey years and age group (years) | | | | | | | | | |
| | Scotland Years 1-4 combined | | | | | UK Years 1-4 combined | | | | |
Source	1.5-3	4-10	11-18	19-64	65+	1.5-3	4-10	11-18	19-64	65+
"5-A-Day" portions (portions/day)[a]	-	-	2.6	3.7	4.3	-	-	2.7	4.0**	4.5
Fruit g/day[b]	119	104	60	90	130	105	106	58	97	130
Vegetables g/day[c]	65	78	100	160	172	72*	97**	112*	182**	186
Oil rich fish g/day[d]	1	2	2	6	9	1	2	2	8	13*
Red and processed meat g/day[e]	31	48	59	72	63	30	45	60	71	63
Bases (unweighted)	*125*	*307*	*396*	*650*	*217*	*604*	*1277*	*1497*	*2697*	*753*

* p<0.05 and ** p<0.01 denotes a statistical difference between UK RP1-4 and Scotland RP Y1-4 (reference group) of equivalent age group.
[a] To calculate "5-A-Day" portions 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.

Fruit and vegetables (see Table 1.2[31])

- Mean consumption of "5-A-Day" fruit and vegetable portions was significantly lower in Scotland compared with the UK for men aged 19 to 64 years (3.6 compared with 4.0 portions) and women aged 19 to 64 years (3.7 compared with 4.0 portions). In Scotland, 24% of adults aged 19 to 64 years (22% of men and 25% of women) met the "5-A-Day" recommendation[32] compared to 28% of adults aged 19 to 64 years in the UK (28% of both men and women), however these differences only reached significance when males and females were combined.

- In Scotland, mean consumption of fruit and vegetables for children aged 11 to 18 years was 2.6 portions per day. Ten per cent of boys and 7% of girls in this age group met the "5-A-Day" recommendation. Mean consumption of fruit and vegetables for adults aged 65 years and over was 4.3 portions per day. Thirty-five per cent of this age group met the "5-A-Day" recommendation.[32]

- When fruit and vegetables were considered separately from each other, fruit consumption was similar between Scotland and the UK for all age/sex groups. Vegetable consumption however, was significantly lower in Scotland in all age/sex groups with the exception of girls aged 11 to 18 years and men aged 65

years and over where the consumption was still lower but the difference did not reach statistical significance.

- Mean fruit and vegetable consumption for those aged 11 to 18 and 19 to 64 years showed a clear pattern when split both by equivalised income and by SIMD. Mean fruit and vegetable consumption expressed in grams and as "5-A-Day" portions was significantly lower in quintile 1 (lowest income and the most deprived) than in quintile 5 (highest income and the least deprived). Adults aged 19 to 64 years showed a pattern of increasing fruit and vegetable intake by income and SIMD quintiles from quintile 1 (lowest/most deprived) to quintile 5 (highest/least deprived).

Oil rich fish[14] (see Table 1.2)

- Consumption of oil rich fish[14] was below the recommendation of one portion (140g) per week[10] in all age groups. For example, mean consumption in adults aged 19 to 64 years was estimated to be 45g per week and for adults aged 65 years and over mean consumption was estimated to be 66g per week.

- Mean oil rich fish[14] consumption was similar in Scotland and the UK for all age groups except for adults aged 65 years and over where mean consumption was 9g per day in Scotland, significantly lower than the mean consumption of 13g per day in the UK.

Red and processed meat[33] (see Table 1.2)

- Mean daily consumption of red and processed meat[33] for men aged 19 to 64 years and 65 years and over was 92g and 77g respectively, whilst women aged 19 to 64 years and 65 years and over consumed 54g and 53g respectively. The recommendation in Scotland is that average intake of red and processed meat should be pegged at around 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.

- Mean consumption of red and processed meat[33] was higher in Scotland compared with the UK in boys aged 4 to 10 years (53g compared with 48g) and men aged 19 to 64 years (92g compared with 86g), whilst consumption was similar in Scotland and the UK for girls aged 4 to 18 years and in women aged 19 years and over.

- No consistent differences by equivalised household income quintiles and SIMD quintiles were observed in any age group for red and processed meat[33] consumption.

Energy intake

- Mean reported total energy intake was 4.88 MJ (1156 kcal) for children aged 1.5 to 3 years and 6.50 MJ (1542 kcal) for children aged 4 to 10 years. For children aged 11 to 18 years, mean total energy intake was 7.44 MJ (1768 kcal).

- For adults, mean reported total energy intake was 8.96 MJ (2132 kcal) for men aged 19 to 64 years, 6.56 MJ (1559 kcal) for women aged 19 to 64 years, 8.15 MJ (1937 kcal) for men aged 65 years and over and 6.04 MJ (1435 kcal) for women aged 65 years and over.

- The main types of food contributing to energy intake were 'cereals and cereal products', 'milk and milk products' (for younger children), and 'meat and meat products' (for older children and adults).

- Mean reported energy intake was significantly lower in Scotland compared with the UK for women aged 19 to 64 years (1559 kcals compared with 1613 kcals) and women aged 65 years and over (1435 kcals compared with 1510 kcals).

- No consistent difference was observed for mean reported intakes of total or food energy between income or SIMD quintiles.

Alcohol intake

- On average, adults aged 19 to 64 years who consumed alcohol during the four-day recording period obtained 9.1% of energy intake from alcohol and older adult consumers obtained 5.7%.

- Male consumers aged 19 to 64 years in Scotland had a higher mean intake of alcohol compared with the UK (38.3g and 29.2g respectively) but this was not significantly different. Female consumers aged 19 to 64 years in Scotland had a similar mean intake compared with the UK (18.2g and 19.2g respectively).

- Males aged 16 to 24 years (including non-consumers) in Scotland had a higher percentage of total energy from alcohol than in the UK (6.9% versus 3.0%). This was not tested for statistical significance.

Protein intake (grams and % food energy)

- Mean protein intakes were well above the RNIs in all age/sex groups and provided 14.5-15.2% of food energy for children and 17.0-17.2% for adults, which was similar to UK values.

- For adults 19 to 64 years, mean protein intake, expressed as a percentage of food energy and total energy, tended to increase from the lowest equivalised income quintile (1) through to the highest (5). This pattern was not observed in adults aged 19 to 64 years when split by SIMD quintiles.

Total fat intake (grams and % food energy (see Table 1.3))

- Mean percentage food energy from total fat met the recommendation of no more than 35% food energy in all age/sex groups except for men aged 19 to 64 years and 65 years and over, for whom, on average, total fat provided 35.1% and 36.2% of food energy.

- The main types of food contributing to total fat intake were 'milk and milk products' (mainly for younger children), 'cereals and cereal products', and 'meat and meat products'.

- Mean daily intakes of total fat were generally similar in Scotland to the UK, and where there were differences, none were statistically significant.

- Overall no consistent difference was observed for mean total fat intakes between income or SIMD quintiles, either when expressed as a percentage of food energy intake or in terms of absolute intake.

Saturated fatty acids intake (grams and % food energy (see Table 1.3))

- Mean intake of saturated fatty acids was higher than the recommendation of no more than 11% food energy for all age/sex groups, and provided 13.4% for children aged 4 to 10 years, 12.8% for children aged 11 to 18 years, 12.9% for adults aged 19 to 64 years and 13.9% of food energy for adults aged 65 years and over. Mean intakes were similar to the UK.

- 'Milk and milk products', 'cereals and cereal products', and 'meat and meat products' made similar contributions to saturated fatty acids intakes in adults and older children while in younger children 'milk and milk products' was the largest contributor.

- Overall, no consistent difference was observed in mean saturated fatty acids intakes expressed as a percentage of food energy between income or SIMD quintiles in children or adults.

Trans fatty acids intake (grams and % food energy (see Table 1.3))

- Mean intakes of *trans* fatty acids provided 0.6-0.8% of food energy for all age/sex groups, and thus met the recommendation in Scotland (average intakes to remain below 1% food energy). Mean intakes in Scotland were very similar to those in the UK.

- Overall, no consistent difference was observed in mean intakes of *trans* fatty acids as a percentage of food energy or in terms of absolute intakes between income or SIMD quintiles.

Non-milk extrinsic sugars (NMES) intake (grams and % food energy (see Table 1.3))

- Mean intake of NMES was higher than the recommendation of less than 11% of food energy in all age groups, ranging from 15.4% for children aged 11 to 18 years to 11.5% for adults aged 65 years and over.

- For children, the main sources of NMES intake were non-alcoholic beverages (soft drinks and fruit juice), particularly for those aged 11 to 18 years (contributing 46%), and 'cereals and cereal products' (contributing 20%). For adults aged 19 to 64 years and 65 years and over, the main sources of NMES intake were 'sugar, preserves and confectionery' (contributing 26% and 31% respectively), 'cereals and cereal products' (contributing 22% and 31% respectively), and, in addition, for adults aged 19 to 64 years, non-alcoholic beverages (contributing 26%).

- Mean intakes of NMES as a percentage of food energy were similar in Scotland and the UK.

- No consistent difference was observed in mean intake of NMES as a percentage of food energy or in terms of absolute intake in children aged 4 to 10 years and 11 to 18 years when split either by income or by SIMD. In adults aged 19 to 64 years, NMES intake as a percentage of food energy was significantly higher in the lowest income and the most deprived quintile (13.5% and 13.0% food energy respectively) compared with the highest income and the least deprived quintile (10.6% and 11.0% food energy respectively).

Non-starch polysaccharides (NSP) intake (grams (see Table 1.3))

- Mean intakes for adults did not meet the recommendation in Scotland which is set at a population average intake of 18g per day. Mean intake of NSP was 8.3g per day for children aged 1.5 to 3 years, 10.5g per day for children aged 4 to 10 years, 11.5g per day for children aged 11 to 18 years, and 13.0g per day for adults.

- 'Cereals and cereal products' was the main source of NSP in all age groups, providing about 40% of total intake.

- Mean NSP intakes tended to be lower in all age/sex groups in Scotland compared with the UK. Mean NSP intake was significantly lower in boys aged 4 to 10 years (10.8g per day compared with 11.5g per day) in Scotland compared with the UK. Mean NSP intake was also significantly lower in girls aged 4 to 10 years, women aged 19 to 64 years and women aged 65 years and over in Scotland compared with the UK (10.2g per day, 12.1g per day and 11.7g per day compared with 10.7g per day, 12.8g per day and 13.1g per day respectively).

- In children aged 11 to 18 years and adults aged 19 to 64 years, NSP intake was significantly lower in the lowest income and the most deprived quintile compared with the highest income and the least deprived quintile.

Table 1.3 Average daily intake of selected macronutrients, for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, by age										
	NDNS RP survey years and age group (years)									
	Scotland Years 1-4 combined					UK Years 1-4 combined				
Macronutrient	1.5-3	4-10	11-18	19-64	65+	1.5-3	4-10	11-18	19-64	65+
Total fat % food energy	34.4	33.8	34.0	35.0	35.2	34.0	33.4	34.0	34.6	35.4
Saturated fatty acids % food energy	14.9	13.4	12.8	12.9	13.9	14.7	13.2	12.5	12.6	13.8
Trans fatty acids % food energy[a]	0.7	0.6	0.6	0.7	0.8	0.6	0.6	0.6	0.7*	0.7
NMES % food energy	12.0	14.8	15.4	12.0	11.5	11.9	14.7	15.6	12.1	11.5
NSP g	8.3	10.5	11.5	13.0	13.0	8.2	11.1**	11.8	13.7**	13.9
Bases (unweighted)	*125*	*307*	*396*	*650*	*217*	*604*	*1277*	*1497*	*2697*	*753*

* p<0.05 and ** p<0.01 denotes a statistical difference between UK RP1-4 and Scotland RP Y1-4 (reference group) of equivalent age group.
[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).

Indicator foods and drinks high in fat and sugar

- There were no consistent differences between Scotland and the UK for consumption of 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet'.[21] A summary of key results is shown in Table 1.4. Mean consumption of 'biscuits' was significantly lower in Scotland (13g per day) compared with the UK (17g per day) in children aged 11 to 18 years, but was significantly higher in Scotland (18g per day) compared with the UK (13g per day) in adults aged 65 years and over.

- Mean 'confectionery' consumption was significantly higher in Scotland compared to the UK in children aged 1.5 to 3 years (12g per day compared with 9g per day) and 4 to 10 years (21g per day compared with 18g per day).

- Mean consumption of 'soft drinks, non-diet'[21] tended to be higher in Scotland compared with the UK for children aged 4 to 18 years and adults aged 19 to 64 years but reached statistical significance only in boys aged 11 to 18 years.

- No clear patterns were found for equivalised income and SIMD for indicator foods and drinks high in fat and sugar with the exception of mean consumption of 'soft drinks, non-diet',[21] where consumption in adults aged 19 to 64 years was significantly higher in the lowest compared with the highest income quintile. Mean consumption decreased from quintile 1 to quintile 5 for equivalised income but not for SIMD.

Table 1.4 Average daily intake of indicator foods and drinks high in fat and sugar for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, by age										
Food group (mean in g)	**NDNS RP survey years and age group (years)**									
	Scotland Years 1-4 combined					UK Years 1-4 combined				
	1.5-3	4-10	11-18	19-64	65+	1.5-3	4-10	11-18	19-64	65+
Biscuits[a]	11	16	13	14	18	12	17	17**	13	13**
Buns, cakes and pastries[b]	11	17	15	14	24	8	21	16	16	23
Confectionery[c]	12	21	19	12	8	9*	18*	19	11	5
Soft drinks, non-diet[d]	61	132	292	144	40	63	127	260	135	52
Bases (unweighted)	*125*	*307*	*396*	*650*	*217*	*604*	*1277*	*1497*	*2697*	*753*

* p<0.05 and ** p<0.01 denotes a statistical difference between UK RP1-4 and Scotland RP Y1-4 (reference group) of equivalent age group.
[a] All types of sweet and savoury biscuits, purchased and homemade. Includes cereal bars and flapjacks.
[b] All types, purchased and homemade.
[c] All types of sugar and chocolate confectionery.
[d] All types, including squashes and cordials, carbonates. Not 100% fruit juice. Not mineral water. This food group is referred to as 'Soft drinks, not low calorie' in Appendix R.

Key findings on intakes of iron, calcium, vitamin C, folate and vitamin D

A summary of key results can be found in Tables 1.5 and 1.6.

Iron

- Fifty-four per cent of girls aged 11 to 18 years and 24% of women aged 19 to 64 years had an iron intake below the LRNI.

- No significant differences for iron intakes were observed when comparing Scotland with the UK except in women aged 65 years and over.

- Mean iron intake was significantly lower in the lowest quintile compared with the highest for both income and SIMD in children aged 11 to 18 years and adults aged 19 to 64 years.

Calcium

- For girls, 18% of those aged 11 to 18 years had intakes of calcium below the LRNI.

- No clear pattern of differences for calcium intakes were observed when comparing Scotland with the UK.

- There was a higher proportion of adults aged 19 to 64 years with intakes below the LRNI in the lowest income quintile compared with the highest quintile.

Vitamin C

- Mean daily intake 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.

- No significant differences for vitamin C intakes were observed when comparing Scotland with the UK except for adults aged 19 to 64 years where mean intake was significantly lower in Scotland (76.6mg) compared with the UK (82.9mg).

- Mean vitamin C intake was above the RNI in all income and deprivation quintiles and for all age groups. In all age groups where statistical analysis could be carried out, mean intake was significantly lower in the lowest income and deprivation quintile compared to the highest.

Folate

- Mean intake of folate was below the RNI for girls aged 11 to 18 years (88% of the RNI) but was above the RNI in all other age/sex groups. Ten per cent of girls aged 11 to 18 years had folate intakes below the LRNI.

- The mean folate intake for adults (males and females combined) in Scotland was significantly lower than for the UK.

- Children aged 11 to 18 years and adults aged 19 to 64 years had lower mean folate intakes in the lowest income and most deprived SIMD quintile compared to the highest income and least deprived SIMD quintile.

Vitamin D

- Mean intake of vitamin D was below the RNI for children aged 1.5 to 3 years (26% of the RNI) and for adults aged 65 years and over (32% of the RNI).[16]

- Inclusion of intakes from dietary supplements brought the mean intake up to 30% of the RNI for children aged 1.5 to 3 years and 47% for adults aged 65 years and over.[16]

- Mean dietary intakes of vitamin D in Scotland were very similar to those in the UK for all age groups.

Intakes of other vitamins and minerals

- Intakes below the Lower Reference Nutrient Intake (LRNI)[17] for vitamin A were found in 12% of children aged 11 to 18 years. However the infrequent consumption of vitamin A-rich foods means that a longer recording period is ideally needed to assess the customary vitamin A intake of an individual. A high proportion (23%) of girls aged 11 to 18 years also had riboflavin intakes below the LRNI.

- Mean intakes of most minerals including magnesium, potassium and selenium fell below the RNI for those aged 11 to 18 years and 19 to 64 years, particularly in girls and women.

- Intakes below the LRNI[17] in girls aged 11 to 18 years ranged from 22% for iodine up to 58% for magnesium.

Table 1.5 Average daily intake of selected micronutrients from food sources only, for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, by age

Micronutrients	NDNS RP survey years and age group (years)									
	Scotland Years 1-4 combined					UK Years 1-4 combined				
	1.5-3	4-10	11-18	19-64	65+	1.5-3	4-10	11-18	19-64	65+
Iron mg	6.5	8.5	9.5	10.5	9.9	6.3	8.7	9.6	10.7	10.2
Calcium mg	763	829	803	797	765	773	803	782	807	852**
Vitamin C mg	66.7	86.4	72.7	76.6	79.4	67.5	85.9	78.9	82.9*	83.7
Folate µg	146	191	202	245	235	150	195	210	258*	265**
Vitamin D µg	1.8	2.0	2.1	2.7	3.2	1.9	2.0	2.1	2.8	3.3
Bases (unweighted)	125	307	396	650	217	604	1277	1497	2697	753

* p<0.05 and ** p<0.01 denotes a statistical difference between UK RP1-4 and Scotland RP Y1-4 (reference group) of equivalent age group.

Table 1.6 Proportion of participants with average daily intakes of micronutrients from food sources only below the Lower Reference Nutrient Intake (LRNI), for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, females, by age

Micronutrients	NDNS RP survey years and age groups (years)									
	Scotland Years 1-4 combined					NDNS RP UK Years 1-4 combined				
	Girls		Total	Women		Girls		Total	Women	
	4-10	11-18	girls	19-64	65+	4-10	11-18	girls	19-64	65+
Iron	1	54	31	24	1	1	46	26	23	2
Calcium	0	18	10	8	10	3	19	12	8	4*
Vitamin C	0	1	1	1	1	0	1	1	1	1
Folate	0	10	6	4	5	0	8	4	4	1
Bases (unweighted)	144	197	341	377	137	612	753	1365	1571	436

* p<0.05 and ** p<0.01 denotes a statistical difference between UK RP1-4 and Scotland RP Y1-4 (reference group) of equivalent age group.

Use of dietary supplements

- Seventeen per cent of men and 20% of women aged 19 to 64 years, and 37% of men and 36% of women aged 65 years and over reported taking at least one dietary supplement during the four-day recording period.

- In general, supplement takers had higher intakes of vitamins and minerals from food sources only (i.e. excluding supplements) than those who did not take supplements during the four-day diary period. In general, the percentage of individuals with intakes below the LRNI from food sources only (i.e. excluding supplements) was lower or the same in the supplement takers compared to the non-supplement takers for all age/sex groups.

Estimated Salt intake[34] (see Table 1.7)

Erratum note: The results in this section have been corrected to take account of bias in sodium concentrations originally published in September 2014. This correction has resulted in slightly higher estimates of salt intake than originally published although the overall conclusions are unchanged.

Salt intake has been estimated from urinary sodium excretion. Table 1.7 presents the recommended maximum salt intake per day for adults, which was set by COMA[288] 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.[299]

- For all age/sex groups, except for women aged 65 years and over, the estimated mean salt intake was higher than the recommendation for their age group (when completeness was determined using the standard criteria).[18,19]

- For children aged 11 to 18 years the estimated mean salt intake was 7.1g per day.

- For adults aged 19 to 64 years it was 8.6g per day and for adults aged 65 years and over it was 7.6g per day.

- The results from this survey (based on data collected between 2008 and 2012) suggests a lower mean salt intake for adults aged 19 to 64 years than the 2009 Scotland Urinary Survey, although this difference has not been statistically tested.[35]

Since this report was originally published new data have been published for salt intakes for adults in England (2014)[36] and Scotland (2014).[37] This report has not been updated to reflect these new results.

Table 1.7 Average estimated salt intake (g/day), for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, by age[a]				
NDNS age group[b]	RNI mmol sodium per day[13,c]	Recommended maximum salt intake[288,299,344] (g/day)[c,d]	Scotland Years 1-4 combined[e]	UK Years 1-4 combined[e,f] and England 2011 survey[e,g]
7 to 10 years	50	5	5.1 (n=53)	5.3[e] (n=186)
11 to 18 years	70	6	7.1 (n=80)	7.0[e] (n=377)
19 to 64 years	70	6	8.6 (n=255)	8.5[f] (n=547)
19 to 64 years males	70	6	9.9 (n=119)	9.8[f] (n=250)
19 to 64 years females	70	6	7.4 (n=136)	7.2[f] (n=297)
65 years and over	70	6	7.6 (n=74)	7.6[e] (n=270)

[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 17.1 mmol 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 RP[3] 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.[20]

Biochemical indices of nutritional status (see Tables 1.8 and 1.9)

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

- People obtain vitamin D from two sources: endogenous synthesis when their skin is exposed to ultra violet B (UVB) radiation and from their diet. There was evidence of low vitamin D status in a proportion of participants in all age/sex groups in both Scotland and the UK. Low vitamin D status has implications for bone health (increased risk of rickets and osteomalacia).

- In Scotland, a higher proportion of adults, older adults and boys aged 11 to 18 years had a 25-hydroxyvitamin D (25-OHD) concentration below 25nmol/L (the current threshold indicating vitamin D adequacy) than in the UK.

- The proportion of children in Scotland who had a concentration of 25-OHD below the lower threshold for vitamin D adequacy was 9.2% for children aged 4

to 10 years and 26.1% for those aged 11 to 18 years. For adults this was 32.5% for those aged 19 to 64 years and 29.4% for those aged 65 years and over.

- There was evidence of iron-deficiency anaemia (as indicated by low haemoglobin concentrations) plus low iron stores (plasma ferritin) in a proportion of older girls aged 11 to 18 years (3.1%), women aged 19 to 64 years (3.0%) and women aged 65 years and over (5.2%) in Scotland. These figures are similar to those for the UK.

- A substantial proportion of participants aged four years and over had riboflavin status values (as indicated by EGRAC) in the range currently regarded as indicating biochemical depletion in adults; however, there is uncertainty about whether this is associated with functional consequences (see Chapter 6 for more detail). Percentages of Scotland participants affected were 54.2% of children aged 4 to 10 years (72.4% for the UK), 65.8% of boys aged 11 to 18 years (78.2% for the UK), 84.7% of girls aged 11 to 18 years (similar to the UK, which was 87.8%), 76.9% of adults 19 to 64 years (69.3% for the UK) and 64.4% of adults 65 years and over (47.5% for UK).

- There was little evidence of low status for other micronutrients where normal ranges or thresholds of adequacy have been set. Mean values for thiamin status (as indicated by ETKAC), vitamin C, B_{12}, retinol (vitamin A) and vitamin E fell within the reference range and the proportion falling outside established thresholds indicating low status, where these have been set, was low.

Table 1.8 Key biochemical indices of nutritional status for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, by age

Blood analyte	NDNS RP survey years and age groups (years)							
	Scotland Years 1-4 combined				UK Years 1-4 combined			
	4-10	11-18	19-64	65+	4-10	11-18	19-64	65+
Plasma 25-hydroxyvitamin D (nmol/L) % males and females combined below 25nmol/L[a]	9.2	26.1	32.5	29.4	13.9	22.0	22.8	21.0
Plasma vitamin C (µmol/L) % males and females combined below 11µmol/L[b]	0.0	2.9	3.2	2.7	0.0	1.4	2.2	4.0
Bases (unweighted)								
Plasma 25-hydroxyvitamin D (nmol/L)	*58*	*137*	*319*	*100*	*237*	*523*	*1321*	*338*
Plasma vitamin C (µmol/L)	*57*	*129*	*305*	*93*	*230*	*501*	*1241*	*323*

[a] Department of Health (1998) Nutrition and Bone Health with Particular Reference to Calcium and Vitamin D. Report on Health and Social Subjects no. 49. London: The Stationery office.
[b] Sauberlich HE. Vitamin C status: methods and findings. Annals of the New York Academy of Sciences, 1971; 24: 444–454.

Table 1.9 Key biochemical indices of nutritional status for NDNS RP Scotland Years 1-4 combined compared with NDNS RP UK Years 1-4 combined, females, by age

Haemoglobin (g/L) and plasma ferritin (µg/L)	NDNS RP survey years and age groups (years)[a]					
	Scotland Years 1-4 combined			UK Years 1-4 combined		
	11-18	19-64	65+	11-18	19-64	65+
% below threshold both for haemoglobin[b,c] and plasma ferritin[c,d]	3.1	3.0	5.2	4.9	4.7	3.1
Bases (unweighted)	*62*	*179*	*66*	*236*	*741*	*191*

[a] Due to small cell sizes, participant's results by age group have only been reported where there were sufficient numbers in Scotland.
[b] Haemoglobin: 11y males <115g/L, 11y females <115g/L, 12-14y males <120g/L, 12-14y females <120g/L, 15y+ males <130g/L, 15y+ females (non-pregnant) <120g/L.
[c] Scientific Advisory Committee on Nutrition (SACN). Iron and Health. London: TSO, 2010.
www.sacn.gov.uk/pdfs/sacn_iron_and_health_report_web.pdf (accessed 18.09.14).
[d] Ferritin: 5y+ males <15mg/L, 5y+ females <15mg/L.

Methodological issues

Misreporting of food consumption

Dietary surveys are reliant on self-reported measures of food intake. Previous NDNS and the current NDNS RP are unique amongst large-scale population surveys in their inclusion of doubly labelled water (DLW) as an objective biomarker to validate energy intake (EI) estimated from reported food consumption. There is evidence of mis-reporting of food consumption from the UK NDNS RP survey as in all dietary surveys. A sub-study comparing self-reported EI estimates (from the four-day diary) with an objective measure of total energy expenditure (TEE) using the DLW technique found that reported EI in those aged 16 years and over was about 34% lower than TEE on average (see Chapter 5 and Appendix X for more detail). This should be borne in mind when interpreting the findings.

Diet and nutritional status

Results based on assessment of food and drink consumption over the four-day diary period provides information about dietary intake over a relatively short period. Analysis of blood samples generally provides an indication of the nutritional status of the population over a longer period. Nutritional status indices provide an assessment of availability of nutrients to the body (after absorption) for use in metabolic processes.

It is not possible to make direct comparisons between the dietary data and biochemical results presented in the report due to the elapsed time between the diary recording period and the collection of blood and urine (a gap of at least eight weeks in Year 2 onwards) and also because many of the biochemical indicators generally reflect longer term body stores of a nutrient rather than recent intake.

Days of the week

Weekend days were oversampled in Year 1 and, while weekend days were under-sampled in Year 2 to redress this, there still remains a slight over-representation of weekend days in the Years 1 to 4 combined data.[38] As eating habits vary on different days of the week for some age groups, this could lead to a bias in the reporting of some foods and drinks.

Future reports

A urinary sodium survey of adults aged 19 to 64 years in Scotland[37] and in England[36] which commenced in 2014 as part of the NDNS RP were published in 2016. A direct comparison of estimated salt intakes between Scotland and England are available in the 2014 Scotland sodium survey report published in 2016.[37]

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.

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[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 MRC HNR.

[3] 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).

[4] A boosted sample in Scotland was included from Year 1.

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

[6] Supporting Healthy Choices: A Framework for Voluntary Action. http://www.scotland.gov.uk/Publications/2014/06/8253 (accessed 15/09/14).
[7] http://www.scotland.gov.uk/Publications/2009/06/25133322/0 (accessed 15/09/14).
[8] http://www.scotland.gov.uk/Publications/2010/02/17140721/0 (accessed 15/09/14).

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[9] http://www.scotland.gov.uk/Publications/2014/06/1195 (accessed 15/09/14).

[10] Scottish Dietary Goals (SDGs) were originally set in 1996 and revised in 2013. The SDGs describe the diet that will improve and support the health of the Scottish population and are used to assist with policy development to reduce the burden of obesity and diet-related disease in Scotland. Revised Dietary Goals for Scotland. Scottish Government, May 2013; http://www.scotland.gov.uk/Resource/0042/00421385.pdf (accessed 15/09/14).

[11] .http://www.foodstandards.gov.scot/monitoring-progress-towards-scottish-dietary-goals-2001-2012-report-1

[12] http://www.scotland.gov.uk/Publications/2011/03/17104457/2 (accessed 15/09/14).

[13] 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.

[14] 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.

[15] 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.

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

[17] 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.

[18] The 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 7 to 10 years and no more than 6g/day for those aged 11 years and over

[19] Standard 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. Standard criteria '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.

[20] 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.pdf (accessed 15/09/14).

[21] See Appendix R of this report for a full definition (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R).

[22] 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.

[23] The majority of participants completed four days of the food and drink diary. Only 2% completed three days.

[24] 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.

[25] 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.

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[26] The Scottish Dietary Goals for macronutrients are generally the same as the UK Dietary Reference Values with the exception of *trans* fatty acids. The SDG for *trans* fatty acids is for mean intakes to remain below 1% of food energy intake whereas the DRV is for mean intakes not to exceed 2% of food energy intake.

[27] For total fat and saturated fatty acids, this recommendation applies to adults and children from the age of five years.

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

[29] 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).

[30] Bromley C, et al. (2011) The Scottish Health Survey 2010. Volume 1 :Main Report. The Scottish Government. http://scotland.gov.uk/Resource/Doc/358842/0121284.pdf (accessed 08/08/14).

[31] In the first publication of this report (in September 2014), "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 September 2014.

[32] Department of Health 5 A DAY programme http://www.nhs.uk/Livewell/5ADAY/Pages/5ADAYhome.aspx (accessed 15/09/14).

[33] 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.

[34] 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.

[35] A survey of 24 hour urinary sodium excretion in a representative sample of the Scottish population as a measure of salt intake, April 2011; http://www.food.gov.uk/scotland/researchscot/scotlandresearch/ScotlandProjectList/s14047/#.U-SgkLFwbIU (accessed 15/09/14).

[36] 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 15/02/17).

[37] 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 15/02/17).

[38] This may be explained by the survey design allowing some flexibilitty in the diary start date to help maintain response rates.

1 Introduction

Original author: Beverley Bates
Updated by: Michael Colborne

The National Diet and Nutrition Survey Rolling Programme (NDNS RP) 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 designed to be representative of the UK population.

The NDNS RP was first commissioned by the UK Food Standards Agency (FSA) in 2006 and the core survey is now jointly funded by Public Health England (PHE) and FSA, with additional recruitment boosts funded by Government bodies in Scotland, Wales and Northern Ireland. 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).[1]

The Food Standards Agency in Scotland (FSAS) has responsibility for monitoring the diet of the population in Scotland and has funded additional recruitment in 2008/09 to 2011/12 in order to achieve representative data for Scotland and enable comparisons to be made with UK results.

The four survey years (2008/09 to 2011/12) have been combined to provide a large enough sample on which to base analyses. The report provides information about the diet and nutrient intakes of participants in Scotland and includes results from analysis of blood and urine samples. The report also provides additional analyses of the intakes of key foods and nutrients and nutritional status measures in different income and deprivation groups and comparisons between Scotland and the UK.

The programme 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).[2] Haematological and biochemical analyses of blood samples are carried out at MRC HNR and Addenbrooke's Hospital NHS Trust, Cambridge.

There is a broad consensus in Scotland that dietary intakes need to improve, as defined and underpinned by the Scottish Dietary Goals (SDGs) published by the Scottish Government.[3] The SDGs, provided below, describe in nutrition terms, the diet that will improve and support the health of the Scottish population and are used to assist with

policy development to reduce the burden of obesity and diet-related disease in Scotland.[4]

The sample size for individual NDNS RP fieldwork years is too small to provide trend data to monitor progress towards the SDGs. Progress towards the SDGs is monitored by FSAS using a combination of surveys, but principally by commissioning secondary analysis of the Living Costs and Food Survey (LCF).[5] Results from 2001 to 2012 suggest that little progress has been made in Scotland towards the SDGs.

However, the boost of participant numbers for the NDNS RP in Scotland will provide representative NDNS RP data for Scotland to evaluate in relation to the SDGs and enable Scottish food and nutrient intakes and nutritional status to be understood within a UK context. The data in this report will support work by FSAS and the Scottish Government to facilitate improvements to the diet and nutritional status of children and adults in Scotland.

The specific aims of the NDNS RP in Scotland were 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 the SDGs and other Government recommendations;

- provide information on intakes of key foods and nutrients and nutritional status measures in different income and deprivation groups;

- compare the intakes of key foods and nutrients and nutritional status measures in Scotland with the UK population.

Dietary Goals for Scotland May 2013

Calories	A reduction in calorie intake by 120 kcal/person/day Average energy density of the diet to be lowered to 125 kcal/100g by reducing intake of high fat and/or sugary products and by replacing with starchy carbohydrates (e.g. bread, pasta, rice and potatoes), fruits and vegetables

Fruit & Vegetables	Average intake of a variety of fruit and vegetables to reach at least 5 portions per person per day (> 400g per day)
Oily Fish	Oil rich fish consumption to increase to one portion per person (140g) per week
Red Meat	Average intake of red and processed meat to be pegged at around 70g per person per day Average intake of the very highest consumers of red and processed meat (90g per person per day) not to increase
Fats	Average intake of total fat to reduce to no more than 35% food energy Average intake in saturated fat to reduce to no more than 11% food energy Average intake of *trans* fatty acids to remain below 1% food energy
Sugar	Average intake of NMES[6] to reduce to less than 11% of food energy in children and adults
Salt	Average intake of salt to reduce to 6g per day
Fibre	An increase in average consumption of fibre[7] to increase to 18g/day by increasing consumption of wholegrains, pulses and vegetables

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[1] 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 08/08/14).

[2] For Years 6 onwards, the consortium comprises NatCen and MRC HNR.

[3] Revised Dietary Goals for Scotland. Scottish Government, May 2013; http://www.scotland.gov.uk/Resource/0042/00421385.pdf   (accessed 08/08/14).

[4] Preventing overweight and obesity route map: http://www.scotland.gov.uk/Publications/2010/02/17140721/0 (accessed 08/08/14).

[5] Estimation of Food and Nutrient Intakes from Food Survey data in Scotland http://www.foodbase.org.uk/results.php?f_report_id=749   (accessed 08/08/14).

[6] NMES (Non-Milk Extrinsic Sugars) are also known as added sugars and are found in sweets, biscuits, soft drinks, added to breakfast cereals, table sugar, honey and fruit juice. They are not in milk or integrally present in the cells of food such as fruit and vegetables.

[7] Non starch polysaccharide (NSP) as measured by Englyst method.

2 Overview of methodology

Original author: Sarah Pigott
Updated by: Gary Boodhna

2.1 Introduction

This chapter provides a general overview of the methodology used in Scotland and the rest of the UK for Years 1 to 4 of the NDNS Rolling Programme (RP). 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 Scotland to increase the numbers in this country, thereby allowing comparisons to be made between Scotland and the UK.[1] The samples were drawn from the Postcode Address File (PAF), 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 guardian[2]), 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)[3] 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)[4] 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.[5]

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, 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 400 fully productive individuals (200 adults, 200 children) in Scotland in each survey year (so 800 adults and 800 children for Years 1 to 4 combined). To this end, 1269 addresses were selected from 47 PSUs each year (27 addresses per PSU). In addition, one PSU (27 addresses) was selected for the Run In.[7] During Year 4 it became apparent that the target numbers would not be achieved and so 729 additional addresses in 27 PSUs were issued in quarter 4. In total, 5832 addresses in 216 PSUs were issued for Years 1 to 4 combined (1080 addresses in 40 PSUs were in the core UK sample; 4752 addresses in 176 PSUs formed the Scottish boost sample).

Twenty seven addresses were randomly selected in each selected PSU. 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), or a child only, were selected for interview the 27 addresses in each PSU were randomly allocated to one of two groups as follows.

Survey year	No. addresses at which adult and child selected	No. addresses at which child only selected
1	9	18
2	9	18
3	9	18
4 (quarters 1, 2)	11	16
4 (quarters 3,4)	10	17

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The split was changed in Year 4 with the aim of increasing the number of child participants in order to ensure that the target number of children was 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 governance[6] 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:

Survey year	Fieldwork period
Year 1[7]	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:

	Interviewers (Stage 1)	Nurses (Stage 2)[8]
Quarter 1	April-June	July-September
Quarter 2	July-September	October-December
Quarter 3	October-December	January-March
Quarter 4	January-March	April-June

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).[8] 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 (Years 1 & 3, core UK sample, only)[9]

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; and 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)).[10] Children aged 4 to 15 years[11] 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 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, ActiGraph collection and further CAPI questionnaire administration.

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).[12] Interviewers then introduced the second stage of the survey, asking for permission for the nurse to visit.[13]

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

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 collected the food diary.

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

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 collecting missing detail for foods recorded, 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.

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 distribution of the days of the week can be found in Chapter 5, section 5.1.

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.[12]

Further information about the objective measurement of physical activity and the use of ActiGraphs can be found in Chapter 4, section 4.1.4.

2.5.2 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.[8] 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.

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.

Measurement or procedure	Participant
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 sample	Aged 1.5 to 3 years; diabetics not willing to fast

Fasting blood sample   Aged four years and over

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

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.[14] 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.[15]

24-hour urine sampling

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.

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 also 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 Scotland was carried out by NatCen Social Research's panel of interviewers and nurses.

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.

2.6.3 Training for nurses

Nurse briefings lasted one and a half days and covered equipment training, blood sampling and 24-hour urine 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 and other NatCen surveys 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.

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.[9]

- 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 in Scotland. See Appendix B for more information on sampling design.

2.8.1 Household level response

Overall for Years 1 to 4 combined, of the 5,832 addresses (core and country boost) issued to interviewers in Scotland, 44% were eligible for household selection and 56% 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 91% of eligible addresses. The remaining 9% of addresses refused before the household selection could be carried out. Of eligible households, 56% (1436/ 2545) were productive – i.e. at least one selected participant completed three or four dietary recording days.[16]

(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 53% for Years 1 to 4 combined (55% in Year 1, 55% in Year 2, 51% in Year 3 and 51% in Year 4, giving a sample size of 1,695 fully productive individuals).[16] Analyses in this report (including response rates for subsequent stages/components of the survey) are based on these 1,695 individuals.

Valid height and weight measurements were obtained for almost all fully productive participants (height 95%; weight 94%).

Seventy-five per cent of all fully productive participants were visited by a nurse.[17] 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-one per cent of adults completing at least three diary days and 27% of children completing at least three diary days provided a blood sample. Younger children were less likely to give a blood sample than older children or adults: 9% of those aged 1.5 to 3 years and 21% of those aged 4 to 10 years provided a blood sample compared with 39% of those aged 11 to 18 years and 51% of those aged 19 years and over.

Fifty-eight per cent of participants aged four years and over[18] who completed at least three diary days went on to provide a 24-hour urine sample (59% of adults, 56% 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 72% of eligible children and usable ActiGraph data was collected from 49% of eligible children.

(Table 2.2)

2.9 Weighting the survey data

The weighted sample is representative of the Scotland population living in private households. 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 from any one household to take part. This meant that adults living in households with one or more other adults, and children in households with one or more other child(ren) 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.

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

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[1] Boost samples were also drawn in Northern Ireland (Years 1-4) and Wales (Years 2-4).

[2] A guardian is defined as a person with legal responsibility for the child.

[3] The Main Food Provider (MFP) was 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.

[4] 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.

[5] 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.

[6] 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.

[7] 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 issued over two months and was carried out in all four UK countries (one PSU was selected in Scotland). The Run In sample was drawn in the same way as the NDNS RP 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.

[8] 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 took place between two to four months after the interviewer visits to the household had been completed.

[9] The DLW sub-study recruited from the core UK sample only; individuals from the Scotland boost sample were not eligible for the DLW sub-study.

[10] Based on the Recent Physical Activity Questionnaire developed by the MRC Epidemiology Unit, Cambridge.

[11] 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.

[12] 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.

[13] In addition, a sub-sample of participants from the core sample 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] Nurses qualified and experienced in paediatric phlebotomy took blood samples from children.

[15] This was introduced from Year 1, Quarter 3 onwards.

[16] Of the 1,695 fully productive individuals, 1,665 (98%) completed four dietary days and 30 (2%) completed three days.

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

[18] Participants also had to be fully out of nappies to be eligible for the 24-hour urine sampling element.

3 Socio-demographic characteristics of the NDNS RP Scotland sample

Original authors:Sarah Pigott and Beverley Bates
Updated by: Laura Nass

3.1 Introduction

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

3.2 Sex

In the unweighted NDNS RP sample, 41% of adults (aged 19 years and over) were men and 59% were women, while for children (aged 1.5 to 18 years) 50% were boys and 50% were girls. The sample was weighted to reflect the distribution of males and females in the general population within Scotland.[1]

(Table 3.1)

3.3 Age

The unweighted sample of adults included 75% aged 19 to 64 years and 25% aged 65 years and over. The unweighted sample of children included 15% aged 1.5 to 3 years, 37% aged 4 to 10 years and 48% aged 11 to 18 years. The sample was weighted to bring the proportions in line with the age profile of the Scottish 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 Scotland 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)[2] for their household.

In terms of the HRP's current or most recent job, the proportion of participants' households[3] classified to the main NS-SEC occupational groupings are in line with the Scottish census data (GRO Scotland, 2011).[1]

Participants were categorised according to the housing tenure of the HRP. Around two-thirds of participants (68% adults, 65% children) lived in owner occupied accommodation and around one-fifth (20% of adults, 23% of children) lived in social housing. A further 12% of adults and 11% of children lived in privately rented accommodation. These proportions are in line with those found in the general Scottish population.[1]

(Table 3.4)

Participants aged 16 years and over were asked the age at which they had left full-time education. More than half (51%) reported that they had left school by the age of 16 years but the proportion having done so was much higher amongst older adults (78% of those aged 65 years and over had left school by the age of 16 years).

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 (11% compared with 21% of those aged 50 to 64 years, 23% of those aged 35 to 49 years and 27% of those aged 19 to 34 years). Conversely, the proportion of those having no qualifications increased with age: 7% of those aged 16 to 18 years had no qualifications compared with 51% of those aged 65 years and over.

(Table 3.5)

3.5 Vegetarian and vegan diets

Two per cent of both adults and children reported that they were vegetarian; none of the participants reported following a vegan diet.[4]

(Table 3.6)

3.6 Smoking

Of those aged 16 years and over, 30% of men and 20% of women reported that they were current smokers. These proportions were higher than those reported in the Scottish Health Survey (SHeS) 2012[5,6] where 25% of men and 24% 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. Eight percent of men and 7% of

women were classed as heavy smokers (i.e. they smoked 20 or more cigarettes per day). These proportions are similar to those reported in the General Lifestyle Survey (GLS) 2011 (where 6% of men and 4% of women were classed as heavy smokers).[7]

(Table 3.8)

Information about experience of smoking was collected for children aged 8 to 15 years of age. No young boys aged 8 to 10 years nor girls of the same age reported that they had ever smoked a cigarette. By the age of 13 to 15 years, a fifth of boys and girls (both 20%) reported having ever smoked a cigarette. This is a smaller proportion than reported in the findings of the Scottish Schools Adolescent Lifestyle and Substance Use Survey (SALSUS) 2010[8] where 31% of boys aged 13 to 15 years and 34% of girls of this age reported ever having smoked a cigarette.

(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 Scotland[9] are that women should not regularly drink more than 2-3 units a day and men, 3-4 units a day, and should aim to have at least two alcohol-free days a week.

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

Most adults (69% of men, 57% of women) had drunk alcohol in the last week, including 29% of men and 19% of women who had drunk more than twice the recommended levels on one of these days.

(Table 3.10)

On average among those who drank in the last week, men consumed 8.6 units on the day they drank most in the last week and women consumed 5.5 units.

(Table 3.11)

Alcohol consumption levels amongst NDNS RP adults were slightly higher than those reported in SHeS 2012.[5]

3.7.2 Drinking behaviour amongst children aged 8 to 15 years

Scottish Government advice is that an alcohol-free childhood is the healthiest start.[10] The proportion of children who reported ever having had a proper alcoholic drink (not just a taste) increased with age, from 2% of both boys and girls aged 8 to 10 years, 25% of boys and 21% of girls aged aged 11 to 12 years to around half of boys and girls aged 13 to 15 years (48% and 50% respectively. These proportions are broadly in line with SALSUS 2010 results.[8]

(Table 3.12)

Three per cent of girls aged 13 to 15 years but no boys of the same age reported usually drinking once a week or more.

(Table 3.13)

As discussed in the SALSUS 2010 report,[8] 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. Second, the majority of children's 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.

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[1] General Register Office for Scotland, 2011
http://www.gro-scotland.gov.uk/census/censushm2011/policy-and-methodology/index.html (accessed 08/08/14)

[2] 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.

[3] 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.

[4] Self-reported assessment via question in the CAPI interview.

[5] The Scottish Health Survey 2012: Volume 1 Main Report.
http://www.scotland.gov.uk/Publications/2013/09/3684/downloads (accessed 08/08/14).

[6] Note that NDNS RP results are not directly comparable with SHeS (2012) as age groupings differ in the two surveys

[7] General Lifestyle Survey 2011. Overview report, 2013
http://www.ons.gov.uk/ons/rel/ghs/general-lifestyle-survey/2011/index.html (accessed 08/08/14).

[8] Scottish Schools Adolescent Lifestyle and Substance Use Survey (SALSUS) - National Report 2010.
http://www.drugmisuse.isdscotland.org/publications/abstracts/salsus_national10.htm (accessed 08/08/14).

[9] http://www.drinksmarter.org/ (accessed 08/08/14).

[10] http://www.drinksmarter.org/sensible-drinking-and-you/alcohol-and-young-people (accessed 08/08/14).

4 Physical measurements and physical activity

Original authors: Jenny Mindell and Vasant Hirani
Updated by: Shaun Scholes

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). Comparisons were made, where possible, with data on physical measurements from both the NDNS RP UK sample[1] and the recent health surveys in Scotland.[2] Data presented are for Years 1 to 4 combined (2008/09-2011/12).

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

Measurements of mid upper arm circumference (MUAC) are not reported in this chapter but are included in the archived data (see Appendix W for more details).

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 (m^2) was calculated by the interviewer's CAPI programme. For adult participants whose height could not be measured, estimated height based on demispan[3] was used to calculate BMI.[4] For children aged under two years, the interviewer measured length instead of height and this measurement was used in place of height when calculating BMI for these youngest children.[5] The nurse measured waist and hip circumferences in those aged 11 years and over using an insertion tape measure.[6]

Obesity

In 2010 Scotland had one of the worst obesity records of developed countries[7] and it was predicted that by 2030 over 40% of adults living in Scotland will be obese. Tackling obesity is a key priority for the public health sector in Scotland.[8] The most recent Scottish Health Survey (SHeS) annual report provides a broad overview of current policy initiatives and developments relating to obesity.[9]

Adults

Table 4.1a shows mean BMI and BMI status, in adults, by age group and sex (according to the World Health Organization (WHO)[10] and National Institute for Health and Care Excellence (NICE) classification[11] as shown in Table 4A below). This report has the same BMI classification as used in the NDNS RP UK report, to facilitate comparisons across countries.

Table 4A: BMI classification

BMI (kg/m^2)	Description
Less than18.5	Underweight
18.5 to less than 25	Normal
25 to less than 30	Overweight
30 or more	Obese
40 or more	Morbidly obese

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.[12]

The difference in mean BMI between men and women was not statistically significant.[13] However, a higher percentage of men (44%) than women (34%) were overweight, or were overweight, including obese (72% of men, 63% of women).

In both sexes, mean WHR was significantly higher in the oldest age group (those aged 65 years and over). For example, mean WHR was 0.92 for men aged 19 to 64 years and 0.98 for men aged 65 years and over. For women, mean WHR was 0.83 for those aged 19 to 64 years and 0.87 for those aged 65 years and over. Mean waist circumference was significantly higher in the oldest age group for men only. Mean waist circumference was 96.7cm for men aged 19 to 64 years and 104.1cm for men aged 65 years and over. For women, mean waist circumference was 89.2cm for those aged 19 to 64 years and 92.0cm for those aged 65 years and over.

There were no significant differences between the sexes in the prevalence of raised WHR. A higher percentage of women (50%) than men (34%) had a raised waist circumference, with the difference more marked amongst those aged 19 to 64 years (48% in women, 31% in men).

(Table 4.1a)

Children

New UK World Health Organization (WHO) growth charts for children from birth to four years were introduced for all new births in Scotland from January 2010.[14] Growth standards for the youngest children are based on breastfed babies,[15,16] 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] Differences between the youngest and oldest children should be viewed with caution due to the use of different growth standards.

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 Scottish Government and UK practice for population monitoring.[17,18]

Similar proportions of boys and girls were overweight (14% and 13% respectively); overweight, including obese (32% and 30% respectively); and obese (19% and 16% respectively). 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.[19]

(Table 4.1b)

Comparisons with other surveys

Comparisons of results for adults[20] in the NDNS RP Scotland sample with adults in the NDNS RP UK sample[1] and adults in the Scottish Health Survey 2010/11 (SHeS 2010/11)[7] showed that anthropometric measurements were broadly similar.

Mean BMI was slightly higher in men in the NDNS RP Scotland sample (27.7kg/m^2) than in both the NDNS RP UK sample and SHeS 2010/11 (27.6kg/m^2 in both surveys). The same was true for women (27.8kg/m^2 in the NDNS RP Scotland sample compared with 27.5kg/m^2 in SHeS 2010/11 and 27.4kg/m^2 in the NDNS RP UK sample). The proportion of obese adults was similar in the three surveys. Among men it was 26% in the NDNS RP UK sample, 27% in the NDNS RP Scotland sample and 28% in SHeS 2010/11. In women the proportion was 29% in both the NDNS RP UK and NDNS RP Scotland samples and 28% in SHeS 2010/11.

Mean waist circumference was higher in men in the NDNS RP UK sample (98.3cm) and in the NDNS RP Scotland sample (98.1cm) than in SHeS 2010/11 (96.3cm) but there were no differences among women in the three surveys. In men, raised waist circumference in the NDNS RP Scotland sample (34%) fell midway between levels in the NDNS RP UK sample and SHeS 2010/11 (37% and 32% respectively). In women, raised waist circumference was similar in the NDNS RP Scotland sample and SHeS

2010/11 (50% and 49% respectively) compared with lower levels in the NDNS RP UK sample (46%). It should be noted that these comparisons were not formally tested for statistical significance.

The proportion of boys aged 2 to 15 years who were obese was similar in the NDNS RP Scotland sample and SHeS 2011 sample (20% in both surveys) but slightly lower in the NDNS RP UK sample (18%). The proportion of girls aged 2 to 15 years who were obese was 18% in the NDNS RP UK sample but lower in the NDNS RP Scotland sample and the SHeS 2011 sample (14% and 14.5% respectively). The estimates differ from those shown for children aged 2 to 18 years in Table 4.1b due to the different age range used to allow comparison with the SHeS 2011.[21] It should be noted that these comparisons were not formally tested.

4.1.3 Blood pressure

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 L.
Hypertension was defined as a systolic blood pressure of 140mmHg or above, and/or diastolic blood pressure of 90mmHg or above,[22] and/or taking medication specifically to reduce blood pressure.

Results

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

Mean SBP was significantly higher in men (130.7mmHg) than women (125.6mmHg) and significantly higher in adults aged 65 years and over than in adults aged 19 to 64 years. The difference with age was greater in women (137.9mmHg in those aged 65 years and over, 121.3mmHg in those aged 19 to 64 years) than in men (137.8mmHg and 128.9mmHg, respectively).

Mean DBP, however, varied neither by age group nor sex.

The prevalence of hypertension was significantly greater in older adults than in younger adults. Among adults aged 19 to 64 years, 3% of men and 6% of women were on

treatment for hypertension (i.e. controlled or uncontrolled hypertension),[23] compared with 50% of men and 38% of women aged 65 years and over. Untreated hypertension was twice as common in older women (27% in those aged 65 years and over, 12% in those aged 19 to 64 years) but there were no differences by age group in men (22% in both age groups).

(Table 4.2)

Comparisons with other surveys

Mean SBP and DBP levels in adults were similar in the NDNS RP Scotland and the NDNS RP UK samples. Mean levels of SBP and DBP were not reported in SHeS 2010/11. The proportion with hypertension was similar in the three surveys. Among men it was 34% in the NDNS RP Scotland sample, 33% in SHeS 2010/11 and 32% in the NDNS RP UK sample. Hypertension levels in women appeared slightly higher in both SHeS 2010/11 and NDNS RP Scotland sample (32% and 31% respectively) than in the NDNS RP UK sample (28%).

4.1.4 **Physical activity**

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 Years 2 to 4, use of the ActiGraph was extended from children aged 4 to 10 years to include those aged 11 to 15 years.

A self-completion questionnaire - the Recent Physical Activity Questionnaire; RPAQ (developed by the MRC Epidemiology Unit Cambridge)[24] - 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 aged 16 years and over at the food diary pick-up visit. Participants completed the RPAQ 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.

Physical activity in adults

Estimation of physical activity

Using the Physical Activity Compendium,[25] 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), and
- 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.

Results

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

Median h/d spent in moderate or vigorous physical activities was higher in men (1.2h/d) than in women (0.5h/d). For both sexes, median levels of moderate or vigorous activity were higher in adults aged 16 to 64 years than in those aged 65 years and over. However, because younger men were more active than younger women, the difference with age appeared greater in men (1.3h/d in those aged 16 to 64 years, 0.3h/d in those aged 65 years and over) than in women (0.6h/d and 0.1h/d, respectively). It should be noted that these comparisons were not formally tested.

(Table 4.3)

Comparisons with other surveys

The median h/d spent in moderate or vigorous physical activities were similar in both the NDNS RP Scotland and NDNS RP UK samples (1.2h/d and 1.0h/d in men and 0.5h/d in both surveys in women).

Physical activity in children

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. For any individual, the ActiGraph records different periods during the day spent at different levels of activity, i.e. differing levels of 'counts per minute' (cpm), while they are being 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 participant 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.

Results

The results in Table 4.4 characterise the range of activity levels found in boys and girls in the two age groups. The table shows the average daily volume of physical activity, expressed as median cpm. In both sexes, the median daily volume was higher in those aged 4 to 10 years. The median daily volume was higher in boys, with the gender difference increasing sharply with age. The median cpm in those aged 4 to 10 years were 569cpm and 535cpm in boys and girls, respectively. Equivalent figures for those aged 11 to 15 years were 539cpm and 333cpm. It should be noted that these comparisons were not formally tested.

(Table 4.4)

Comparisons with other surveys

Physical activity in SHeS 2011 has been collected using questionnaire data only. Both the NDNS RP UK and NDNS RP Scotland 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 552cpm in the NDNS RP UK and NDNS RP Scotland samples respectively. Equivalent figures in girls aged 4 to 15 years were 452 and 468cpm. These comparisons were not formally tested.

National Diet and Nutrition Survey. Results from Years 1-4 (combined) of the Rolling Programme (2008/2009 – 2011/12): Scotland. Revised June 2017

[1] 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).

[2] Rutherford L, Sharp C, Bromley C (eds). *The Scottish Health Survey 2011.* Edinburgh: Scottish Executive, 2012. http://www.scotland.gov.uk/Publications/2012/09/7902

[3] 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.)

[4] 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.

[5] These data are not shown but are included in the archived data.

[6] 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 ≥ 0.5cm, weight ≥ 0.2kg, waist and hip circumferences ≥ 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.

[7] Bromley C, et al. (2011) The Scottish Health Survey 2010. Volume 1 :Main Report. The Scottish Government. http://scotland.gov.uk/Resource/Doc/358842/0121284.pdf (accessed 08/08/14).

[8] Scottish Government (2010) Preventing Overweight and Obesity in Scotland: A Route Map Towards Healthy Weight. http://www.scotland.gov.uk/Resource/Doc/302783/0094795.pdf (accessed 08/08/14).

[9] http://www.scotland.gov.uk/Publications/2013/09/3684/downloads (accessed 08/08/14).

[10] *World Health Organization Body mass index (BMI) classification.* www.who.int/bmi/index.jsp?introPage=intro_3.html (accessed 08/08/14).

[11] National Institute of Health and Clinical Excellence. *Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children.* Dec 2006 (page 221) www.nice.org.uk/guidance/index.jsp?action=download&o=38295. (accessed 08/08/14).

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

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

[14] 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 08/08/14).

[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 08/08/14).

[16] 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.

[17] Scottish Intercollegiate Guideline Network. Management of Obesity. Guideline No 115, Edinburgh: SIGN, 2010. www.sign.ac.uk/pdf/sign115.pdf (accessed 08/08/14).

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

[19] 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.
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 08/08/14).

[20] 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 SHeS, those aged 16 years and over are defined as adults. In the results, 'younger' means from that minimum age up to 64 years.

[21] Rutherford L, Hinchliffe S, Sharp C (eds). *The Scottish Health Survey 2012.* Edinburgh: Scottish Executive, 2012. It should be noted that the SHeS excludes children whose BMI was more than 7 standard deviations above or below the norm for their age. The SHeS 2011 estimates shown are revised figures: originally, cases which were more than 3 standard deviations above or below the mean were excluded.

[22] 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 (accessed 08/08/14). Within the constraints of the survey, blood pressure was measured three times, and the average of the second and third readings used for analysis.

[23] 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).

[24] 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.

[25] 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.

[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

Original authors: Alison Lennox, Celia Prynne and Gillian Swan
Updated by: Caireen Roberts, Toni Steer, Sonja Nicholson, Nida Ziauddeen, David Pell, Polly
Page and Alison Lennox

Erratum note: Correction to fruit and vegetable consumption estimates including from composite dishes (section 5.3)
In the first publication of this report (in September 2014), 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 Scotland sample for Years 1 to 4 combined of the NDNS Rolling Programme (RP). Analysis is based on both Scotland core cases from the UK sample and Scotland boost cases providing an overall Scotland sample of 1,695 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.

The Scottish Dietary Goals (SDGs)[1] provide the foundation for diet and health policy in Scotland. Unless stated otherwise, the SDGs relate to the current UK recommendations for food and nutrient intakes.[2] The annual sample size in Scotland in the NDNS RP is too small to provide trend data to monitor the SDGs.[3] Progress towards the SDGs is monitored by the Food Standards Agency in Scotland using a combination of surveys, but principally by commissioning secondary analysis of the Living Costs and Food Survey (LCF) (before 2008 known as the Expenditure and Food Survey (EFS)). Results from 2001 to 2011 suggest that little progress has been made in Scotland towards SDGs.[4]

Results in this chapter are based on dietary assessment using a four-day estimated food diary and represent a daily average of the days assessed.[5] 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). 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 Scotland sample, there remains a slight over-representation of weekend days compared with weekdays (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 Scotland only**

Day of the week	All UK		Scotland	
	Number of diary days	% of total days	Number of diary days	% of total days
Monday	3,677	13.5	936	13.9
Tuesday	3,477	12.8	855	12.7
Wednesday	3,382	12.4	814	12.1
Thursday	3,879	14.3	961	14.3
Friday	4,234	15.6	1,026	15.3
Saturday	4,302	15.8	1,077	16.1
Sunday	4,232	15.6	1,041	15.5

Dietary surveys are reliant on self-reported measures of food intake. Misreporting of food consumption, generally underreporting, in self-reported dietary methods is well-documented. The underreporting of energy intake (EI) is known to be an issue in past and current NDNS, as for all dietary surveys and studies.[6,7]

This is an important consideration when interpreting the findings from this survey. Previous NDNS and the current NDNS RP are unique amongst large-scale population surveys in their inclusion of doubly labelled water (DLW)[8] 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 Scotland due to the small number of participants from Scotland (35) in the DLW population.

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 provides a summary of the DLW method, the results obtained and an illustration of a number of considerations relevant to the interpretation of the survey findings.

In order to reduce population EI in Scotland as part of the Preventing Obesity Route Map Action Plan,[9] specific foods and drinks high in fat and/or high in sugar have been targeted for population level reduction. These are monitored annually in terms of volume sales and calories purchased and include 'soft drinks non-diet',[10] 'confectionery', 'biscuits' and 'buns, cakes and pastries'.[11] An overview of consumption of these categories, along with key nutrients, are presented with a more detailed age breakdown for young people and adults in Chapter 8, and by equivalised income and Scottish Index of Multiple Deprivation (SIMD) in Chapter 9. Comparisons between the Scotland sample and the UK sample are reported in Chapter 10.

5.2 Foods consumed

Tables 5.1a-5.1c show mean consumption of standard NDNS food groups for the total Scotland sample (i.e. including non-consumers, those who did not consume from a food group during the four-day diary recording 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. Details of the food groups can be found in Appendix R.

(Tables 5.1a-5.2c)

5.2.1 Cereals and cereal products

For all age groups, except those aged 65 years and over, 'white bread' and 'pasta, rice, pizza and other miscellaneous cereals' were the most commonly consumed 'cereals and cereal products', eaten by more than 75% over the four-day diary period. Children aged 10 years and under consumed similar quantities of bread (all types combined) and 'pasta, rice, pizza and other miscellaneous cereals', as did adults aged 19 to 64 years. Children aged 11 to 18 years consumed more 'pasta, rice, pizza and other miscellaneous cereals' than bread; adults aged 65 years and over consumed more bread.

'Biscuits' were also consumed by more than 70% of those aged 10 years and under and those aged 65 years and over.

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. Over half of participants in all age groups consumed 'cheese' over the four-day recording period, ranging from 55% of children aged 11 to 18 years up to 81% of children aged 1.5 to 3 years.

5.2.3 Fat spreads

For all age groups, except those aged 65 years and over, 'reduced fat spread (not polyunsaturated)' was the most commonly consumed fat spread. For adults aged 65 years and over, 'butter' was the most commonly consumed fat spread.

5.2.4 Meat and meat products and dishes

Consumption figures for 'meat and meat products and dishes' presented in Tables 5.1a-5.2c include non-meat components of composite and recipe dishes. 'Chicken, turkey and dishes' was the most commonly consumed type of meat for children aged 4 to 18 years and adults aged 19 to 64 years. For adults aged 65 years and over, the most commonly consumed type of meat was 'bacon and ham', with 59% having eaten this type of meat over the four-day recording period. For children aged 1.5 to 3 years, the per cent consumers was similar across 'bacon and ham', 'beef, veal and dishes' and 'chicken, turkey and dishes' (54-55%).

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' were adults aged 65 years and over (29%), followed by adults aged 19 to 64 years (19%). For children, 6-9% consumed 'oily fish' over the four-day recording 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

This section refers to fruit and vegetables consumed as discrete items excluding 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.

Children aged 1.5 to 3 years were the highest per cent consumers of 'fruit' over the four-day recording period (93%), followed by children aged 4 to 10 years (91%). Children aged 11 to 18 years were the lowest per cent consumers of 'fruit' (66%).

'Vegetables (not raw) including vegetable dishes' were consumed by 75% or more participants in all age groups. 'Salad and other raw vegetables' were less commonly consumed; particularly by children where around less than 50% in all age groups ate this type of food over the four-day recording period.

The highest percentage of consumers of 'chips, fried and roast potatoes and potato products' was in those aged 4 to 10 years and 11 to 18 years (78% and 76% respectively) and lowest in those aged 65 years and over (54%).

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 (21g per day) and 11 to 18 years (19g per day). 'Chocolate confectionery' was consumed by 71% of children aged 1.5 to 3 years, 60% of children aged 4 to 10 years and 55% of children aged 11 to 18 years over the four-day recording period. 'Sugar confectionery' was less commonly consumed than 'chocolate confectionery' in the 1.5 to 3 years (45%) and 11 to 18 years age groups (32%). Mean consumption of 'sugar confectionery' and 'chocolate confectionery' combined was lowest in those aged 65 years and over (7g per day). However, this age group had the highest mean consumption of 'table sugar, preserves and sweet spreads' (16g per day).

5.2.8 Beverages

Children aged 4 to 10 years were the highest per cent consumers of 'fruit juice' over the four-day recording period (65%) while adults aged 19 to 64 years were the lowest (37%). Children aged 10 years and under consumed more 'soft drinks, low calorie' than 'soft drinks, not low calorie'. Highest mean consumption of 'soft drinks, not low calorie' was seen in children aged 11 to 18 years (292g per day) while highest mean consumption of 'soft drinks, low calorie' was seen in children aged 1.5 to 3 years (212g per day). Eighty per cent of children aged 11 to 18 years consumed 'soft drinks, not low calorie' over the four-day recording period compared to 60% who consumed 'soft drinks, low calorie'.

For 'alcoholic beverages', those aged 19 to 64 years had the highest mean consumption of total 'alcoholic beverages'. For 'wine', men aged 65 years and over and women aged 19 to 64 years had the highest mean consumption over the four-day recording period (56-57g per day) and were the highest per cent consumers of this type of alcohol (35-36%). Men aged 19 to 64 years had the highest mean consumption of 'beer, lager, cider and perry' over the four-day recording period (374g per day) and were the highest per cent of consumers of this type of alcohol (43%). As noted in section 5.1, there is a slight over-representation of weekend days compared to weekdays in the Years 1 to 4 combined data for Scotland (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 recording 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.

Total mean vegetable consumption based on disaggregated data was 65g per day for children aged 1.5 to 3 years, 78g per day for children aged 4 to 10 years and 100g per day for children aged 11 to 18 years. For adults, those aged 19 to 64 years consumed a mean of 160g per day and those aged 65 years and over, 172g per day. Total mean fruit consumption was 119g per day for children aged 1.5 to 3 years, 104g per day for those aged 4 to 10 years and 60g per day for children aged 11 to 18 years. Adults aged 19 to 64 years consumed a mean of 90g per day and adults aged 65 years and over, 130g per day. Mean consumption of fruit juice was highest in children aged 4 to 10 years (96g per day) and lowest in those aged 65 years and over (42g 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 2.6 portions per day.[12] Adults aged 19 to 64 years consumed 3.7 portions per day, while adults aged 65 years and over consumed 4.3 portions per day.

The proportion of participants meeting the "5-A-Day" guideline was 9% of children aged 11 to 18 years, 24% of adults aged 19 to 64 years and 35% 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. Total meat consumption based on disaggregated data was 110g per day for adults aged 19 to 64 years and 85g per day for adults aged 65 years and over. Consumption of red meat was 72g per day for adults aged 19 to 64 years and 63g per day for adults aged 65 years and over. The current SDG is that average intakes of red and processed meat should be pegged at around 70g per day and that the average intake of the very highest consumers of red and processed meat (90g per person per day) should not increase.[13]

Mean consumption of oily fish was well below the SDG of at least one portion (140g) per week[14] in all age groups: for adults aged 19 to 64 years, mean consumption was equivalent to 45g per week and equivalent to 66g per week for adults aged 65 years and over.[15]

(**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 SDGs and UK DRVs.[1, 2,16] For total fat, saturated and *trans* fatty acids and non-milk extrinsic sugars (NMES) the recommendations are the maximum contribution these nutrients should make to the population average diet.[17] For total carbohydrate, *cis*-monounsaturated fatty acids and non-starch polysaccharide (NSP) the recommendations are for the population average. 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.[16] 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 4.88 MJ (1156 kcal) for children aged 1.5 to 3 years, 6.50 MJ (1542 kcal) for children aged 4 to 10 years, 7.44 MJ (1768 kcal) for children aged 11 to 18 years, 8.96 MJ (2132 kcal) for men aged 19 to 64 years, 6.56 MJ (1559 kcal) for women aged 19 to 64 years, 8.15 MJ (1937 kcal) for men aged 65 years and over and 6.04 MJ (1435 kcal) for women 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 (77.2-79.8% of the EAR in adults aged 19 to 64 years and 65 years and over and 71.1% in children aged 11 to 18 years) (see underreporting in section 5.1).

'Cereals and cereal products' was the main source of energy for all age groups, contributing 32% of energy intake for children aged 1.5 to 3 years, 34% for children aged 4 to 18 years and 31-33% for adults aged 19 years and over. 'Milk and milk products' was the second largest contributor to energy intake for children aged 1.5 to 3 years (23%) while 'meat and meat products' was the second largest contributor to energy intake for children aged 11 to 18 years (17%) and adults aged 19 years and over (15-18%). Children aged 4 to 10 years derived a similar proportion of energy from 'milk and milk products' and 'meat and meat products' (14-15%).

(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 14.5-15.2% of food energy for children and 17.0-17.2% 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 (37-39%), decreasing to 30% in children aged 4 to 10 years. 'Cereal and cereal products' was the second largest contributor to protein intake for these age groups, providing 26-28% for children aged 4 to 18 years and 23% for adults aged 19 years and over. 'Milk and milk products' was the major contributor to protein intake for children aged 1.5 to 3 years, providing 33% of intake, with 'meat and meat products' and 'cereal and cereal products' both providing 24%.

(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 ranged from 47.8% of food energy (adults aged 19 years and over) to 51.7% (children aged 4 to 10 years).

The major contributor to carbohydrate intake was 'cereals and cereal products', providing 43-44% for children aged 1.5 to 18 years and 44-47% for adults aged 19 years and over. 'Milk and milk products' contributed 14% of carbohydrate intake for children aged 1.5 to 3 years. 'Non-alcoholic beverages' contributed 15% for children aged 11 to 18 years, mainly from soft drinks. For adults aged 19 years and over, 'vegetables and potatoes' provided 13% of carbohydrate intake.

(Tables 5.4 and 5.7)

5.4.4 Non-milk extrinsic sugars

The SDG for non-milk extrinsic sugars (NMES) is that the population average intake should reduce to less than 11% of food energy intake in children and adults. Mean intakes of NMES as a percentage of food energy failed to meet the goal in all age groups ranging from 11.5% for adults aged 65 years and over to 15.4% for children aged 11 to 18 years.

For children, the main sources of NMES were 'non-alcoholic beverages' (fruit juice and soft drinks), 'cereals and cereal products' (predominantly 'biscuits' and 'buns, cakes, pastries and fruit pies'), and 'sugar, preserves and confectionery'. 'Non-alcoholic beverages' contributed 46% to NMES intake for those aged 11 to 18 years, 32% for those aged 4 to 10 years and 24% for those aged 1.5 to 3 years. Of these, soft drinks contributed 36% to NMES intake for children aged 11 to 18 years and 12-18% for children aged 10 years and under while 'fruit juice' contributed 10-14% in children across the age groups. 'Cereals and cereal products' contributed 20-25% and 'sugar, preserves and confectionery' contributed 19-24% to NMES intake in children.

For adults aged 19 to 64 years, the main sources of NMES were 'sugar, preserves and confectionery' (26%), 'non-alcoholic beverages' (26% mainly from soft drinks) and 'cereals and cereal products' (22%) (predominantly 'biscuits' and 'buns, cakes, pastries and fruit pies). 'Alcoholic beverages' provided a further 9% of NMES intake. 'Cereals and cereal products' and 'sugar, preserves and confectionery' were the main contributors to NMES intake for adults aged 65 years and over (both providing 31%).

(Tables 5.4 and 5.8)

5.4.5 Non-starch polysacchaides

The SDG for non-starch polysaccharides (NSP) states that average consumption should be 18g per day to be achieved by increasing consumption of wholegrains, pulses and vegetables. Mean intakes were 8.3g per day for children aged 1.5 to 3 years and 10.5-11.5g per day for children aged 4 to 18 years. For adults aged 19 years and over, mean intakes were less than the SDG at 13.0g per day.

'Cereals and cereal products' was the main source of NSP for all age groups, contributing 42-43% for children aged 1.5 to 18 years and 39-40% for adults aged 19 years and over. 'Vegetables and potatoes' were the second major contributor to NSP, showing an increasing contribution with age, from 19% in children aged 1.5 to 3 years to 29% for adults aged 19 years and over.

(Tables 5.4 and 5.9)

5.4.6 Total fat

The SDG for total fat is that the population average intake should reduce to no more than 35% of food energy intake.[17] Mean percentage food energy from total fat met the recommendation in all age/sex groups, except for men aged 19 to 64 years and 65 years and over where total fat provided 35.1% and 36.2% of food energy respectively.

'Milk and milk products' was the major contributor to total fat intake for children aged 1.5 to 3 years, providing 32%, (13% from 'whole milk'). 'Milk and milk products' also provided 20% of total fat intake for children aged 4 to 10 years along with 22% from 'cereals and cereal products' and 20% from 'meat and meat products'. For the other age groups the main sources were 'meat and meat products', contributing 20-25% of total fat intake, and 'cereals and cereal products', contributing 20-23%. Adults aged 65 years and over derived 15% of their total fat intake from 'fat spreads', mainly from 'butter' (7%).

(Tables 5.4 and 5.10)

5.4.7 Saturated fatty acids

The SDG for saturated fatty acids is that the population average intake should reduce to no more than 11% of food energy intake.[17] Mean intakes of saturated fatty acids failed to meet the SDG for all age groups at 13.4% for children aged 4 to 10 years, 12.8% for children aged 11 to 18 years, 12.9% 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 43% and 31% respectively. This food group was also among the main sources of saturated fatty acids for the other age groups, providing 20-24%. Other key sources were 'cereals and cereal products' contributing 17-24% to intakes across all age groups and 'meat and meat products' contributing 14% for children aged 1.5 to 3 years, 18% for children aged 4 to 10 years, 24% for children aged 11 to 18 years and 20-25% for adults aged 19 years and over. 'Fat spreads' contributed 15% to saturated fatty acids intake for adults aged 65 years and over, mainly from 'butter' (9%).

(**Tables 5.4 and 5.11**)

5.4.8 *Trans* fatty acids

The SDG for *trans* fatty acids is that the population average intake should remain below 1% of food energy.[17] 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 SDG.[18]

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 (36%). 'Milk and milk products' was also a key source of *trans* fatty acids for older children and adults, providing 23-27%. The contribution of 'meat and meat products' to *trans* fatty acid intake was 15-20% in children aged 10 years and under, 25% in children aged 11 to 18 years and 23-28% in adults aged 19 years and over. 'Cereals and cereal products' contributed 14-20% to *trans* fatty acid intake across the age groups, mainly from 'pasta, rice, pizza and other miscellaneous cereals' and from 'buns, cakes, pastries and fruit pies'.

(**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 11.6-12.8% 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 0.7% for children aged 1.5 to 3 years to 1.0% for adults aged 65 years and over.

Mean intake of *cis* n-6 PUFA expressed as a percentage of food energy, ranged from 3.9% for children aged 1.5 to 3 years to 4.9% 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).[19] In the Years 1 to 4 combined data, there is a slight over-representation of weekend days compared to weekdays 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).

For adult consumers, alcohol provided on average 9.1% and 5.7% of energy intake for those aged 19 to 64 years and 65 years and over respectively. A higher proportion of adults aged 19 to 64 years (53%) consumed alcohol than did adults aged 65 years and over (47%); in both age groups, the proportion of male consumers was higher than female consumers. For male consumers aged 19 to 64 years, alcohol intakes at the upper 2.5 percentile provided 50.4% of energy intake over the four-day recording period.

Nine per cent of participants aged 11 to 18 years consumed alcohol in some form during the four-day recording period, and for consumers, alcohol provided on average 7.1% of energy intake. Most of the consumers of alcoholic beverages in the 11 to 18 years age group were aged 15 to 18 years. It should be noted that as cell sizes for alcohol consumers are limited in the 11 to 18 years age group, caution should be taken when interpreting the data for this age group.

Questions about alcoholic beverage consumption were also asked in the Computer Assisted Personal Interview (CAPI) 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 recording 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 are reported in section 5.7.

For those vitamins and minerals for which UK RNIs and Lower Reference Nutrient Intakes (LRNIs) have been published,[2] the proportions 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 taken 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

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 will be included in the dataset deposited at the UK Data Archive[20] (details can be found in Appendix W). Plasma concentrations of carotenoids and retinol are presented in Chapter 6.

Mean daily intakes of vitamin A from food sources were close to or above the RNI for all age/sex groups. Twelve per cent of children aged 11 to 18 years 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 and 4 to 10 years, providing 33% and 25% respectively. Vegetables was the major contributor to vitamin A intake for adults aged 19 years and over providing 25-26% of intake. For children aged 11 to 18 years, the contribution from 'milk and milk products' (19%) and from vegetables (20%) was similar.

'Milk and milk products' was the largest contributor to retinol intake for all age groups, except those aged 65 years and over, with the contribution decreasing with age from 54% for children aged 1.5 to 3 years to 28% for adults aged 19 to 64 years. 'Fat spreads' was the second largest contributor to retinol intake and the contribution increased with age from 19% for children aged 1.5 to 3 years to 26% for adults aged 19 to 64 years. For those aged 65 years and over, the contribution from 'milk and milk products' and from 'fat spreads' was the same (28%). 'Meat and meat products' contributed an additional 8-10% to retinol intake for adults and less for children (5-7%).

(Table 5.15-5.17a and 5.21-5.22)

Thiamin

Mean daily intakes of thiamin from food sources were well above the RNI for all age/sex groups. The proportion of individuals with intakes below the LRNI was 1% or less.

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 43-45% of intake for children aged

1.5 to 18 years and 36-37% 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)

Riboflavin

Mean daily intakes of riboflavin from food sources were above the RNI for all age/sex groups. However, 17% of children aged 11 to 18 years (11% of boys, 23% of girls) and 10% of adults aged 19 to 64 years (8% of men, 13% of women) 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, 44% for children aged 4 to 10 years and 29-33% for children aged 11 to 18 years and adults aged 19 years and over. 'Cereals and cereal products' was the second largest contributor, providing 30-31% of riboflavin intakes for children aged 4 to 18 years and 22-25% for children aged 1.5 to 3 years and adults aged 19 years and over, primarily from fortified breakfast cereals. 'Meat and meat products' contributed an additional 15-18% to riboflavin intake for adults and older children and less for children aged 10 years and under (8-9%).

(Table 5.15-5.17a and 5.24)

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.
'Cereals and cereal products' was the largest contributor to intake of niacin for children aged 1.5 to 3 years and 4 to 10 years, providing 34%. 'Meat and meat products' was the largest contributor for older children aged 11 to 18 years and adults aged 19 years and over, providing 33-37% of niacin intake.

(Table 5.15-5.17a and 5.25)

Vitamin B_6

Mean daily intakes of vitamin B_6 from food sources were well above the RNI for all age/sex groups. Less than 0.5% of participants had intakes of vitamin B_6 from food sources below the LRNI.

'Cereals and cereal products' was the largest contributor to vitamin B_6 intake for children in all age groups (23-25%). For adults, the major contributors were 'meat and meat products' (21-24%) and 'vegetables and potatoes' (19-22%). 'Milk and milk products' also provided 20% of vitamin B_6 intakes for children aged 1.5 to 3 years.

(**Table 5.15-5.17a and 5.26**)

Vitamin B_{12}

Mean daily intakes of vitamin B_{12} from food sources were well above the RNI for all age/sex groups. The proportion of individuals with intakes below the LRNI was 3% or less.

'Milk and milk products' was the largest contributor to vitamin B_{12} intake for all age groups, with the contribution highest for children aged 1.5 to 3 years (63%) decreasing to 33% for adults aged 19 years and over. The second largest contributor was 'meat and meat products' with the contribution increasing with age from 17% for children aged 1.5 to 3 years to 27-30% for children aged 11 to 18 years and adults aged 19 years and over.

(**Table 5.15-5.17a and 5.27**)

Folate

Mean daily intakes of folate from food sources were above the RNI for all age/sex groups except girls aged 11 to 18 years (88% of the RNI). Ten per cent of girls aged 11 to 18 years had intakes from food sources below the LRNI. The inclusion of dietary supplements had no 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 28-29% for adults aged 19 years and over. Fortified breakfast cereals provided about half of this for children aged 10 years and under. 'Vegetables and potatoes' also provided 23-25% of folate intakes for adults aged 19 years and over and 17-20% for children aged 4 to 18 years. 'Milk and milk products' also provided 13% of folate intake for children aged 4 to 10 years and 19% for children aged 1.5 to 3 years. 'Beer, lager, cider and perry' contributed 9% to folate intakes for men aged 19 to 64 years.

(**Table 5.15-5.17a and 5.28**)

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 aged 1.5 to 18 years was 'non-alcoholic beverages', providing 34-41%, of which 13-19% came from 'fruit juice' and 18-22% from soft drinks. For adults aged 19 years and over, the main source was 'vegetables and potatoes', providing 35-38% of vitamin C intake. 'Vegetables and potatoes' also contributed 13-25% to vitamin C intake for children aged 1.5 to 18 years. 'Fruit' provided 29% of vitamin C intake for children aged 1.5 to 3 years and 21% for children aged 4 to 10 years decreasing to 13% for children aged 11 to 18 years. 'Fruit' contributed 19% to vitamin C intake for adults aged 19 to 64 years and 25% for adults aged 65 years and over.

(Table 5.15-5.17a and 5.29)

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: 26% of the RNI for children aged 1.5 to 3 years and 32% for adults aged 65 years and over. Inclusion of intakes from dietary supplements brought the mean intake up to 30% of the RNI for children aged 1.5 to 3 years and 47% for adults aged 65 years and over. There are no LRNIs set for vitamin D.

'Meat and meat products' was the major contributor to vitamin D intake for all age groups, except children aged 1.5 to 3 years, providing 24-36% of intake. 'Milk and milk products' was the major contributor to vitamin D intake for children aged 1.5 to 3 years, providing 25%. 'Fat spreads', most of which have added vitamin D, contributed 18-21% to intake across the age groups. 'Cereals and cereal products' provided 15-19% of intake across the age groups, from breakfast cereals (via fortification) and from 'buns, cakes, pastries and puddings' (via fats and eggs used as ingredients). The contribution from 'fish and fish dishes' was higher for adults aged 19 years and over (14-18%) than for children aged 1.5 to 18 years (7-9%) and was mainly from 'oily fish', a rich source of vitamin D.

(Table 5.15-5.16a and 5.30)

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.[2] Mean intakes of vitamin E were well above these levels for men and women aged 19 years and over.

'Cereals and cereal products' were the main source of vitamin E for all age groups, except for adults aged 19 to 64 years, providing 21-24% of intake. For those aged 19 to 64 years, 'vegetables and potatoes' and 'cereal and cereal products' made a similar contribution (18-19%). 'Fat spreads' contributed an additional 10-15% to vitamin E intakes across the age groups.

(**Table 5.15-5.15a and 5.31**)

5.6.2 Vitamin intakes for supplement takers versus non-supplement takers

For most age/sex groups, supplement takers had higher or similar mean intakes of vitamins from food sources only compared to non-supplement takers.[21] For example, women aged 19 to 64 years who took supplements during the four-day recording period had a mean vitamin C intake of 92.7mg from food sources only compared to 73.8mg for those who did not take supplements. The percentage of individuals with intakes below the LRNI from food sources only was the same or lower in the supplement takers compared to the non-supplement takers for all age/sex groups. For example, 17% of non-supplement takers aged 11 to 18 years had intakes from food sources only below the LRNI for riboflavin compared to 12% of supplement takers. It should be noted that there are small numbers of supplement takers in the Scotland sample and this should be taken into account when interpreting findings.

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

Iron

Mean daily intakes of iron from food sources were below the RNI for some age/sex groups, particularly girls aged 11 to 18 years where the mean intake was 55% of the RNI and women aged 19 to 64 years where the mean intake was 77% of the RNI. Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI.

Fifty-four per cent of girls aged 11 to 18 years and 24% 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 54-55% for children aged 10 years and under to 40-41% for adults aged 19 years and over. Within 'cereals and cereal products', bread and fortified breakfast cereals were the main source of iron intake. The other main contributors to iron intake were 'meat and meat products' which provided 18-21% of intake for children aged 11 to 18 years and adults aged 19 years and over, and less for younger children, and 'vegetables and potatoes' which provided 14-15% of intake in adults aged 19 years and over and 9-12% in children aged 1.5 to 18 years.

(**Table 5.33-5.35a and 5.39**)

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.

Eighteen per cent of girls and 8% of boys aged 11 to 18 years had calcium intakes from food sources below the LRNI. Eight 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 (60%) decreasing to 36-37% for children aged 11 to 18 years and adults aged 19 to 64 years. The second largest contributor was 'cereals and cereal products' with the contribution highest for children aged 11 to 18 years (36%) and lowest for children aged 1.5 to 3 years (24%).

(**Table 5.33-5.35a and 5.40**)

Magnesium

Mean daily intakes of magnesium from food sources were below the RNI for children aged 11 to 18 years (70% of the RNI), adults aged 19 to 64 years (86% of the RNI) and adults aged 65 and over (81% of the 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 (30% of boys, 58% of girls), 16% of adults aged 19 to 64 years (19% of men, 12% of women) and 17% of adults aged 65 and over (22% of men, 13% of women) 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 28-32%. 'Milk and milk products' contributed 25% to magnesium intake for children aged 1.5 to 3 years. Across the age groups, 'vegetables and potatoes' contributed 10-15% and 'meat and meat products' contributed 9-16% to magnesium intake.

(Table 5.33-5.35a and 5.41)

Sodium

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

'Cereals and cereal products' was the largest contributor to sodium intake from food for all age groups, providing 31-37%, of which 17-18% came from bread. 'Meat and meat products' was the second largest contributor for all age groups, providing 21-29% of sodium intake from food. 'Milk and milk products' contributed 17% for children aged 1.5 to 3 years and 8-11% for the other age groups.

(Table 5.42)

Potassium

Mean daily intakes of potassium from food sources were below the RNI for children aged 11 to 18 years (68% of the RNI), adults aged 19 to 64 years (77% of the RNI) and adults aged 65 years and over (76% of the RNI). Inclusion of intakes from dietary supplements made little difference to mean intakes as a percentage of the RNI.

Twenty-seven per cent of children aged 11 to 18 years (15% of boys, 41% of girls), 20% of adults aged 19 to 64 years (14% of men, 26% of women) and 20% of adults aged 65 years and over (11% of men, 27% of women) had potassium intakes from food sources below the LRNI. Dietary supplements had no impact on the proportions with intakes below the LRNI.

'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 22-23%. '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 29% and 22% of intake respectively. Across the age groups, 'cereals and cereal products' contributed 14-17% and 'meat and meat products' 10-18% of potassium intake. 'Fruit' provided 15% of potassium intake for children aged 1.5 to 3 years.

(**Table 5.33-5.35a and 5.43**)

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 (88% of the RNI) and children aged 11 to 18 years (90% and 79% 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.

Sixteen per cent of children aged 11 to 18 years (10% of boys, 23% of girls) and 12% of girls aged 4 to 10 years had zinc intakes from food sources below the LRNI. Dietary supplements had no impact on the proportion with intakes below the LRNI.

'Meat and meat products' was the largest contributor to zinc intake for children aged 11 to 18 years and adults aged 19 years and over, providing 34-37%. For those aged 4 to 10 years, 'meat and meat products' and 'cereal and cereal products' made the same contribution (28%) to zinc intake. 'Milk and milk products' was the major contributor to zinc intake for children aged 1.5 to 3 years, providing 35%.

(**Table 5.33-5.35a and 5.44**)

Copper

Mean daily intakes of copper from food sources were below the RNI for women aged 19 to 64 years (80% of the RNI) and women aged 65 years and over (78% 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 33-42%. 'Vegetables and potatoes' contributed 9-14% and 'meat and meat products' 12-17% of copper intake.

(**Table 5.33-5.34a and 5.45**)

Selenium

Mean daily intakes of selenium from food sources were below the RNI for children aged 11 to 18 years (71% of the RNI), adults aged 19 to 64 years (69% of the RNI) and adults aged 65 years and over (63% of the 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 (28% of boys, 50% of girls), 43% of adults aged 19 to 64 years (32% of men, 55% of women) and 54% of adults aged 65 years and over (37% of men, 67% of women) had selenium intakes from food sources below the LRNI. Dietary supplements had little impact on the proportions with intakes below the LRNI.

The main source of selenium for children aged 10 years and under was 'cereals and cereal products', providing 30-32% of intake. For adults aged 19 years and over, the main source of selenium was 'meat and meat products', providing 27-33% of intake. For children aged 11 to 18 years, 'meat and meat products' and 'cereals and cereal products' provided the same proportion (34%) of selenium intake. 'Fish and fish dishes' contributed 21% to selenium intakes for adults aged 65 years and over, decreasing to 10% for children aged 11 to 18 years.

(**Table 5.33-5.35a and 5.46**)

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 (81% of the RNI). The inclusion of intakes from dietary supplements had little impact on mean intakes as a percentage of the RNI.

Twenty-two per cent of girls aged 11 to 18 years had iodine intakes from food sources below the LRNI. Eight 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 (62%) decreasing to 33% for adults aged 19 years and over. Across the age groups, 'cereals and cereal products' provided 10-16% of iodine intake. Adults aged 65 years and over derived 19% of their iodine intake from 'fish and fish dishes'.

(**Table 5.33-5.35a and 5.47**)

5.6.4 Mineral intakes for supplement takers versus non-supplement takers

Supplement takers in all age/sex groups had higher mean intakes of all minerals from food sources only compared to the non-supplement takers.[21] The percentage of individuals with intakes from food sources only below the LRNI was generally higher in the non-supplement takers. For example, the percentage of women aged 65 years and over with selenium intakes from food sources only below the LRNI was higher in the non-supplement takers group (76%) than in the supplement takers group (50%). It should be noted that there are small numbers of supplement takers in the Scotland sample and this should be borne in mind when interpreting findings.

(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.

Eighteen per cent of adults aged 19 to 64 years (17% of men, 20% of women) and 37% of adults aged 65 years and over (37% of men, 36% of women) had taken at least one supplement during the four-day diary recording period. For children, supplement use was most common among children aged 4 to 10 years with 14% taking at least one supplement during the four-day diary period.

Apart from adults aged 65 years and over, 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. 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-six per cent of adults aged 65 years and over (29% of men, 25% of women) 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 generally below the recommendation in all relevant age groups. Adults aged 65 years and over were most likely to meet the "5-A-Day" guideline. This age group also had the highest consumption of oily fish, although this still fell below the recommended one portion per week.

The SDG for total fat was met or very close to being met for all age groups. The recommendation in Scotland for *trans* fatty acids was met in all age groups. However intakes of saturated fatty acids were in excess of the SDG for all age groups. NMES intakes also exceeded the SDG in all age groups.

There was also 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 capture intakes of micronutrients that are found in a limited number of foods.

In general, supplement takers had higher intakes of vitamins and minerals from food sources only than those who did not take supplements during the four-day recording period. However, it should be noted that there are small numbers of supplement takers in the Scotland sample and this should be borne in mind when interpreting findings.

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

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[1] Scottish Dietary Goals were originally set in 1996 and a revised update was published in 2013. http://www.scotland.gov.uk/Resource/0042/00421385.pdf (accessed 08/08/14).

[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] Wrieden WL, Barton KL, Armstrong J & McNeil G (2006) A review of food consumption and nutrient intakes from national surveys in Scotland: comparison to the Scottish Dietary Targets. Aberdeen: Food Standards Agency in Scotland. http://www.food.gov.uk/multimedia/pdfs/scotdietrytarg.pdf (accessed 08/08/14).

[4] http://foodbase.org.uk/results.php?f_report_id=749 (accessed 08/08/14).

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[5] Participants with dietary data for at least three days were included in the analyses (only 30 of the 1695 participants had three rather than four days of dietary data).

[6] 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.

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

[8] 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 (^{2}H) and oxygen (^{18}O$_2$) 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 CO_2 is produced from metabolism. Energy expenditure can then be estimated from the CO_2 production.

[9] http://www.scotland.gov.uk/Publications/2011/03/17104457/2 (accessed 08/08/14).

[10] See Appendix R of this report for a full definition (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R).

[11] http://www.scotland.gov.uk/Publications/2012/11/4673 (accessed 08/08/14).

[12] "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).

[13] Scientific Advisory Committee on Nutrition. Iron and Health. London: TSO, 2010

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

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

[16] Scientific Advisory Committee on Nutrition. Dietary Reference Values for Energy: http://www.sacn.gov.uk/pdfs/sacn_dietary_reference_values_for_energy.pdf (2011) (accessed 08/08/14).

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

[18] It should be noted that the SDG for *trans* fatty acid intakes is different from the UK recommendation that *trans* fat intakes should not exceed 2% of food energy.

[19] Consumers also include those who consumed alcohol in recipes and other foods.

[20] http://www.data-archive.ac.uk (accessed 08/08/14).

[21] 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).

6 Blood analytes

Sonja Nicholson, Lorna Cox, Polly Page, Chris Bates and Ann Prentice

6.1 Introduction

This chapter reports the results of the analysis of blood samples taken during the nurse visit from participants in Scotland aged four years and over. Samples were collected between February 2008 and July 2012; Years 1 to 4 of the NDNS Rolling Programme (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

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 general practitioner (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.[1]

6.1.1 Obtaining the blood sample

Blood samples were requested from all fully productive participants[2] aged 1.5 years and over who were visited by a nurse (1,257 individuals) where 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 1.5 to 15 years, 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, 21.1mL from participants aged 7 to 15 years 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 the age of the participant:

Age group	Tubes
1.5 to 6 years	1 x EDTA, 1 x lithium heparin, 1 x serum gel and 1 x serum
7 to 15 years	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, 51% of adults and 27% of children provided a blood sample. Younger children were less likely to give a blood sample than older children or adults: 9% of those aged 1.5 to 3 years and 21% of those aged 4 to 10 years provided a blood sample compared with 38% of those aged 11 to 18 years.

Blood samples were obtained from a total of 667 fully productive participants. However due to small cell sizes for children aged 1.5 to 3 years, this report presents analytical results for up to 216 children aged 4 to 18 years and 440 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. Children aged 1.5 to 3 years and diabetic participants who were not willing or not able to fast 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 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.[1]

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.[3] 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).[3] Results are presented for the age groups 4 to 10 years, 11 to 18 years, 19 to 64 years and 65 years and over and are split by sex, except data for the age group 4 to 10 years which are presented as sex

combined only due to limited numbers. Results for the 1.5 to 3 years age group are not presented as the cell size for this age group is too small (below 30).

Only limited comparisons have been made with blood analyte data from the NDNS RP UK Years 1 to 4 report due to limited numbers for all age/sex groups in the Scotland dataset.[4] These comparisons are presented in section 6.8 of this chapter, however these are descriptive only as no statistical analysis of differences have been performed.

Cell sizes for males aged 65 years and over are small and this should be borne in mind when interpreting the results for this group. 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)[5] and are endorsed by the UK Scientific Advisory Committee for Nutrition (SACN).[6]

Table 6A: Lower limits set by WHO[5] and endorsed by SACN[6] 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 children aged 4 to 10 years was 130g/L. For boys aged 11 to 18 years the mean haemoglobin concentration was 144g/L and for girls aged 11 to 18 years it was 132g/L.

The mean haemoglobin concentration for men aged 19 to 64 years was 148g/L, 142g/L for men aged 65 years and over, 132g/L for women aged 19 to 64 years and 129g/L for women aged 65 years and over.

The proportion of children with a haemoglobin concentration below the lower limits was 0.6% for children aged 4 to 10 years and 4.1% 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 4.0% for men aged 19 to 64 years, 19.1% for men aged 65 years and over, 10.2% for women aged 19 to 64 years and 17.7% for women aged 65 years and over.

(**Table 6.1**)

6.2.2 Plasma ferritin (*micrograms/litre, μg/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.[6]

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 12μg/L for children aged 1.5 years to 10 years and 15μg/L for children aged 11 to 14 years, and also men and non-pregnant women aged 15 years and over.[5,6]

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 children aged 4 to 10 years was 32μg/L. The mean plasma ferritin concentration for boys aged 11 to 18 years was 48μg/L and 29μg/L for girls aged 11 to 18 years.

The mean plasma ferritin concentration for men aged 19 to 64 years was 143μg/L and 126μg/L for men aged 65 years and over. The mean plasma ferritin concentration for women aged 19 to 64 years was 61μg/L and 114μg/L for women aged 65 years and over.

The proportion of children with a ferritin concentration below the lower limit of the normal range was 12.2% for children aged 4 to 10 years, 6.9% for boys aged 11 to 18 years and 18.7% for girls aged 11 to 18 years.

The proportion of adults with a ferritin concentration below the lower limit of the normal range was 2.6% for men aged 19 to 64 years, 9.6% for women aged 19 to 64 years and 8.0% for women aged 65 years and over. There were no cases below the lower threshold in this dataset for men aged 65 years and over.

(**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.[6] The combination of haemoglobin and ferritin concentrations can be used as a measure of iron status and/or deficiency.

The proportion of children with a haemoglobin concentration and a plasma ferritin concentration below which iron deficiency is indicated was 3.1% for girls aged 11 to 18 years. There were no cases below the threshold for children aged 4 to 10 years or boys aged 11 to 18 years.

The proportion of adults with a haemoglobin concentration and plasma ferritin concentration below which iron deficiency is indicated was 0.8% for men aged 19 to 64 years, 3.0% for women aged 19 to 64 years and 5.2% for women aged 65 years and over. There were no cases below the threshold for men aged 65 years and over. Table Q.1 presents descriptive statistics for plasma soluble transferrin receptors.

(**Table 6.1**)

6.3 Water-soluble vitamins

6.3.1 Plasma vitamin C (*micromoles/litre, µmol/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 11µmol/L indicates biochemical depletion.[7]

The mean concentration for every age/sex group was above the level indicative of biochemical depletion for vitamin C.

The mean plasma vitamin C concentration for children aged 4 to 10 years was 71.2μmol/L, 56.8μmol/L for boys aged 11 to 18 years and 52.6μmol/L for girls aged 11 to 18 years.

The mean plasma vitamin C concentration for men aged 19 to 64 years was 43.6μmol/L, 42.4μmol/L for men aged 65 years and over, 53.6μmol/L for women aged 19 to 64 years and 48.2μmol/L for women aged 65 years and over.

The proportion of children who had a vitamin C concentration below the level indicative of biochemical depletion was 2.6% for boys aged 11 to 18 years and 3.3% for girls aged and 11 to 18 years. There were no cases below the threshold for children aged 4 to 10 years.

The proportion of adults who had a vitamin C concentration below the level indicative of biochemical depletion was 4.0% for men aged 19 to 64 years, 4.4% for men aged 65 years and over, 2.4% for women aged 19 to 64 years and 1.5% for women aged 65 years and over.

(**Table 6.2**)

6.3.2   Serum vitamin B_{12} (*picomoles/litre, pmol/L*)

Vitamin B_{12} 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 B_{12} is the commonly used measure of vitamin B_{12} status. Vitamin B_{12} 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 B_{12} 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.[8] The lower threshold of the normal range for serum vitamin B_{12} concentration for all ages is usually accepted as 150pmol/L.[9]

The mean serum vitamin B_{12} concentration for children aged 4 to 10 years was 450pmol/L, 324pmol/L for boys aged 11 to 18 years and 290pmol/L for girls aged 11 to 18 years.

The mean serum vitamin B_{12} concentration for men aged 19 to 64 years was 259pmol/L, 245pmol/L for men aged 65 years and over, 257pmol/L for women aged 19 to 64 years and 266pmol/L for women aged 65 years and over. Thus, the mean

concentration for every sex/age group was above the lower threshold of the normal range of 150pmol/L.

In the 11 to 18 years age group; 1.6% of boys and 10.1% of girls had a vitamin B_{12} concentration below the lower threshold of the normal range (150pmol/L).[9] There were no cases below the threshold for children aged 4 to 10 years.

The proportion of adults who had a vitamin B_{12} concentration below the lower threshold of the normal range of 150pmol/L was 4.5% for men aged 19 to 64 years, 8.4% for men aged 65 years and over, 8.8% for women aged 19 to 64 years and 10.6% for women aged 65 years and over.

(**Table 6.2**)

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

Thiamin (vitamin B_1) 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.[8] As with most water-soluble vitamins, there is no recognisable 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.[10]

The mean ETKAC in children was 1.09 for those aged 4 to 10 years and 1.12 for those aged 11 to 18 years. In adults mean values were 1.12 for those aged 19 to 64 years and 1.11 for those aged 65 years and over, with little difference between men and women.

No more than 1.6% 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 B_2). 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.[11] 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 B_2 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.[12]

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.[11] 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 B_2) status.

The mean EGRAC in girls and boys aged 4 to 10 years was 1.34, 1.43 for boys aged 11 to 18 years and 1.55 for girls aged 11 to 18 years.
The mean EGRAC was 1.42 for men aged 19 to 64 years, 1.49 for men aged 65 years and over, 1.47 for women aged 19 to 64 years and 1.42 for women aged 65 years and over.

The highest proportion of individuals with EGRAC above the 1.30 threshold potentially indicating poorer B_2 status[11] was in girls aged 11 to 18 years and women aged 19 to 64 years (84.7% and 77.7% respectively). The proportion of boys and girls aged 4 to 10 years with an EGRAC above this threshold was 54.2%. The proportion of adults aged 65 years and over with EGRAC greater than 1.30 (64.3% of men and 64.4% of women) was lower than the proportion of adults aged 19 to 64 years with EGRAC above this threshold (76.2% of men and 77.7% of women).

The values at the 75th percentile ranged from 1.42 for children aged 4 to 10 years to 1.69 for girls aged 11 to 18 years. The values at the 90th percentile ranged from 1.51 for children aged 4 to 10 years to 1.91 for girls 11 to 18 years.

(**Table 6.2**)

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

Vitamin B_6 comprises pyridoxal, pyridoxine, pyridoxamine and their 5'-phosphates, which are metabolically interconvertible. Pyridoxal-5-phosphate (PLP) is the primary biologically active form of vitamin B_6, 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 B_6 requirements are therefore related to protein synthesis needs.[8] PLP may be decreased during acute phase reaction;[13] 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 B_6 status.

There is currently no internationally recognised normal range for PLP concentration. Pyridoxic acid (PA), a less sensitive measure of vitamin B_6 status but less affected by acute phase, was also measured; results for PA are presented in Appendix Q.

The mean PLP concentration for children aged 4 to 10 years was 67.3nmol/L, 81.2nmol/L for boys aged 11 to 18 years and 60.3nmol/L for girls aged 11 to 18 years.

The mean PLP concentration for men aged 19 to 64 years was 56.2nmol/L, 49.3nmol/L for men aged 65 years and over, 61.1nmol/L for women aged 19 to 64 years and 47.2nmol/L for women aged 65 years and over.

(**Table 6.2**)

6.4 Fat-soluble vitamins and carotenoids

6.4.1 Plasma retinol (vitamin A) (*micromoles/litre, μmol/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.[14] For adults, concentrations below 0.35μmol/L are considered to reflect severe deficiency and concentrations between 0.35μmol/L and 0.70μmol/L to reflect mild deficiency.[10]

The mean plasma retinol concentration for children aged 4 to 10 years was 1.24μmol/L, 1.59μmol/L for boys aged 11 to 18 years and 1.61μmol/L for girls aged 11 to 18 years.

The mean plasma retinol concentration for men aged 19 to 64 years and 65 years and over and women aged 19 to 64 years and 65 years and over was 2.16μmol/L,

2.10μmol/L, 2.14μmol/L and 2.20μmol/L respectively. Thus, the mean concentration for all age/sex groups was above the limit of marginal status for retinol.

No children aged 4 to 18 years had a retinol concentration below the level associated with severe deficiency (0.35μmol/L) in an adult population.[10]

The proportion of adults who had a retinol concentration below the level associated with severe deficiency (0.35μmol/L)[10] was 0.5% for women aged 19 to 64 years, whilst there were no cases below the threshold among adult men aged 19 years and over nor women aged 65 years and over.

The proportion of children aged 4 to 10 years who had a retinol concentration at a level associated with mild deficiency in an adult population (0.35-0.70μmol/L)[10] was 0.7%, whilst there were no cases below the threshold for children aged 11 to 18 years.

There were no cases of adults aged 19 years and over who had a retinol concentration at a level associated with mild deficiency (0.35-0.70μmol/L).[10]

(**Table 6.3**)

6.4.2 Plasma α- and β-carotene and α- and β-cryptoxanthin (*micromoles/litre, μmol/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, μmol/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.[15,16] A higher threshold has been adopted by some countries to indicate population vitamin D sufficiency; the UK Scientific Advisory Committee for Nutrition (SACN) convened a working group in 2011 to review the thresholds and is expected to report in 2014.

Plasma 25-OHD concentration is not split by season in this report due to small sample sizes, however due to larger sample sizes in the UK NDNS RP (which includes the Scotland participants reported in this chapter) 25-OHD was split by season in the UK NDNS RP report.[4] As the survey was spread evenly across the year, values in Table 6.3 are year-round averages.

The mean 25-OHD concentration for children aged 4 to 10 years was 47.0nmol/L. The mean 25-OHD concentration for boys aged 11 to 18 years was 38.0nmol/L and 36.5nmol/L for girls aged 11 to 18 years.

The mean 25-OHD concentration for men aged 19 to 64 years was 39.9nmol/L and 43.4nmol/L for men aged 65 years and over. The mean 25-OHD concentration for women aged 19 to 64 years was 40.2nmol/L and 40.2nmol/L for women aged 65 years and over.

The proportion of children who had a 25-OHD concentration below 25nmol/L at the time of venepuncture was 9.2% for children aged 4 to 10 years, 29.0% of boys aged 11 to 18 years and 23.0% 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 31.7% of men aged 19 to 64 years, 26.3% of men aged 65 years

and over, 33.3% of women aged 19 to 64 years and 31.6% of women aged 65 years and over.

The proportions of adults aged 19 to 64 years and 65 years and over in the NDNS RP Years 1 to 4 (2008-2012) Scottish population with 25-OHD concentration below 25nmol/L are similar to the proportion identified by the Scottish Health Survey 2010-2011 in those aged 16 years and over[17] which indicated that in Scotland, over the whole year, approximately one third of the adult population had a plasma 25-OHD concentration below 25nmol/L. It should be noted that the samples were analysed in different laboratories, albeit using the same method, and that the sample collection and other pre-analytical procedures were also different. Although only limited comparisons can be made between these results; they can be regarded as mutually confirmatory.

(**Table 6.3**)

6.4.5 Plasma α-tocopherol (*micromoles/litre, μmol/L*)

Vitamin E is a group of compounds called tocopherols. Alpha 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 (μmol/mmol), enabling comparisons to be made between groups with different plasma lipid concentations.

For adults, a concentration of total plasma tocopherols below 11.6μmol/L, of which approximately 93% would be α–tocopherol, or a plasma tocopherol to cholesterol ratio of below 2.25μmol/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 2.25μmol/mmol to be the lowest satisfactory value for adults.[8]

The mean plasma α-tocopherol concentration for children aged 4 to 10 years was 21.3μmol/L, 23.3μmol/L for boys aged 11 to 18 years and 25.5μmol/L for girls aged 11 to 18 years.

The mean plasma α-tocopherol concentration for men aged 19 to 64 years and 65 years and over and women aged 19 to 64 years and 65 years and over was 31.1μmol/L, 31.3μmol/L, 32.3μmol/L and 34.1μmol/L respectively.

Alpha-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 was 5.06μmol/mmol for children 4 to 10 years, with 12.4% having a ratio of α-tocopherol to total cholesterol less than the lowest satisfactory value in an adult population.[8]

The mean ratio of α-tocopherol to total cholesterol for boys aged 11 to 18 years and girls aged 11 to 18 years was 6.06μmol/mmol and 5.92μmol/mmol respectively. The proportion of children with a ratio of α-tocopherol to total cholesterol below the lowest satisfactory value defined for an adult population[8] was 3.7% of boys aged 11 to 18 years and 1.1% of girls aged 11 to 18 years.

The mean ratio of α-tocopherol to total cholesterol was 6.24μmol/mmol and 7.11μmol/mmol for men aged 19 to 64 years and 65 years and over, with no cases for men aged 19 years and over having a ratio of α-tocopherol to total cholesterol lower than the lowest satisfactory value.

The mean ratio of α-tocopherol to total cholesterol was 6.23μmol/mmol and 6.30μmol/mmol for women aged 19 to 64 years and 65 years and over. The proportion of women aged 19 to 64 years with a ratio of α-tocopherol to total cholesterol below the lowest satisfactory value defined for an adult population[8] was 0.3%, whilst there were no cases in this dataset of women aged 65 years and over having a ratio of α-tocopherol to total cholesterol less 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 or 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 (triacylglycerol) 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. Approximately a third of adults aged 19 years and over 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 total serum cholesterol between 6.5 and 7.8mmol/L indicating moderately elevated cardiovascular risk was 8.1% of men and 8.8% of women aged 19 to 64 years, and 7.3% of men and 12.8% of women aged 65 years and over. The proportion of adults with a total serum cholesterol above 7.8mmol/L indicating severe risk was 1.2% of men and 1.7% of women aged 19 to 64 years, no cases for men aged 65 years and over and 5.4% of women aged 65 years and over.

(**Table 6.4**)

6.6 Selenium and zinc

6.6.1 Plasma selenium (*micromoles/litre, μmol/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 of the small volume of blood taken from these children which precluded inclusion of these analyses, therefore plasma selenium concentration is provided for children aged 7 to 10 years rather than for children aged 4 to 10 years. Mean plasma selenium concentration was 0.90μmol/L for children aged 7 to 10 years, 0.91μmol/L for boys aged 11 to 18 years and 0.88μmol/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 1.04μmol/L for men aged 19 to 64 years, 1.02μmol/L for men aged 65 years and over, 1.08μmol/L for women aged 19 to 64 years and 1.00μmol/L for women aged 65 years and over.

(**Table 6.5**)

6.6.2 Plasma zinc (micromoles/litre, μmol/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.[8] 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 of the small volume of blood taken from these children which precluded inclusion of these analyses, therefore plasma zinc concentration is provided for children aged 7 to 10 years rather than for children aged 4 to 10 years. Mean plasma zinc concentration was 15.00μmol/L for children aged 7 to 10 years, 14.59μmol/L for boys aged 11 to 18 years and 14.36μmol/L for girls aged 11 to 18 years.

Mean plasma zinc concentration was 14.57μmol/L for men aged 19 to 64 years, 13.42μmol/L in men aged 65 years and over, 13.43μmol/L for women aged 19 to 64 years and 13.44μmol/L for women aged 65 years and over respectively.

(Table 6.5)

6.7 Summary of the nutritional status of the Scotland 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, with a higher preponderance in females. The proportion of females who had concentrations below the threshold for both haemoglobin and plasma ferritin was 3.1% of girls aged 11 to 18 years, 3.0% of women aged 19 to 64 years and 5.2% of women aged 65 years and over.

There is evidence of low vitamin D status at the time of venepuncture in all reported age/sex groups; this has implications for bone health (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.

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, B$_{12}$, thiamin as indicated by ETKAC, retinol and vitamin E fell within the normal range.

The proportion of adults who had a serum total cholesterol concentration between 5.2 and 6.4mmol/L indicating a marginally increased risk of cardiovascular disease was 36.1% and 31.0% for those aged 19 to 64 years and 65 years and over respectively. A further 8.5% of adults aged 19 to 64 years and 10.7% of those aged 65 years and over had serum cholesterol in the range 6.5 to 7.8mmol/L indicating a moderately elevated cardiovascular risk and another 1.4% of adults aged 19 to 64 years and 3.3% of those 65 years and over were greater than 7.8mmol/L, indicating severe risk.

6.8 Comparisons between the Scotland 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 Scotland and UK data:

- The number of blood samples obtained in Scotland was 667. The sample size for blood samples obtained from UK participants[22] 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 has 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 findings 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 Scotland and the UK. The proportion with a haemoglobin concentration and a plasma ferritin concentration below which iron deficiency is indicated was 3.1% and 4.9% of girls aged 11 to 18 years and 3.0% and 4.7% of women aged 19 to 64 years for Scotland and the UK respectively.

- There is evidence of low vitamin D status in all age/sex groups in both Scotland and the UK. Low vitamin D status has implications for bone health, increasing the risk of rickets and osteomalacia. In all age/sex groups, except those aged 4 to 10 years (sex combined) and girls aged 11 to 18 years, a higher proportion of participants in Scotland than in the UK had a 25-OHD concentration below 25nmol/L (the current threshold indicating vitamin D adequacy) at the time of venepuncture. Results are summarised in Table 6B, however it should be noted that no statistical analysis of the differences has been performed.

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

	% of respective dataset with 25-OHD concentration <25nmol/L cell sizes for each age group are shown in brackets						
	4-10y (sex combined)	11-18y boys	11-18y girls	19-64y men	19-64y women	65y+ men	65y+ women
Scotland	9.2% (58)	29.0% (73)	23.0% (64)	31.7% (137)	33.3% (182)	26.3% (34)	31.6% (66)
UK	13.9% (237)	19.7% (273)	24.4% (250)	24.0% (551)	21.7% (770)	16.9% (140)	24.1% (198)

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[1] http://www.data-archive.ac.uk (accessed 08/08/14).

[2] Participants were classed as "fully productive" if they completed three or four days of the food and drink diary.

[3] Hornung, RW, Reed, LD. Estimation of Average Concentration in the Presence of Nondetectable Values. Applied Occupational and Environmental Hygiene, 1990, 5: 46-51.

[4] 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).

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

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

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

[8] 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).

[9] WHO. Conclusions of a WHO technical consultation on folate and vitamin B_{12} deficiencies. Food and Nutrition Bulletin. 2008; 29. S238–S244.

[10] 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.

[11] 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.

[12] 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.

[13] 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.

[14] 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.

[15] 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).

[16] 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.

[17] http://foodbase.org.uk/results.php?f_report_id=845 (accessed 08/08/14).

[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 blood samples obtained from participants in Scotland.

7 24-hour analyses: sodium excretion and estimated salt intake

Sonja Nicholson, Lorna Cox, Nida Ziauddeen, Polly Page, Chris Bates and Ann Prentice

Erratum note: Correction to data

This chapter was excluded from the original report published in September 2014 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 Archive[4] 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 sodium surveys.[1,2]

7.1 Introduction

This chapter presents the estimated salt intakes based on 24-hour urinary sodium excretion data from participants aged 4 years and over in Scotland 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 four 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.[11,12] The Reference Nutrient Intakes (RNI)[13] for sodium, set in 1991 by the Committee on Medical Aspects of Food and Nutrition Policy's (COMA) panel on Dietary Reference Values,[14] 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 COMA[11] 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.[12] The Scottish Dietary Goals, (SDGs)[15] include a goal to reduce average population salt intakes to 6g/day.

Table 7A **The Reference Nutrient Intake (RNI)[13 14] for sodium and the corresponding maximum recommended salt intake per day[11,12]**

NDNS age group	RNI[13 14] (mmol sodium per day*)	Maximum recommended salt intake[11,12] ** (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

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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.[12] Therefore, as for the previous England and Scotland sodium surveys[6,8,10] 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 PABA[17] 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 England and Scotland sodium surveys[6,8,10] 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 Archive[4]

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 $-20^{o}C$ and later analysis of sodium, potassium, urea, creatinine and nitrogen (see appendix U of this report); urine remaining after analysis was retained at $-20^{o}C$, 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 4 years and over) 905 24-hour urines (from 430 males and 475 females) were received at HNR and a total of 902 sodium results were obtained (from 430 males and 472 females). Of these 24-hour urines with a sodium result, 53.8% of collections (485) were classified as 'complete by standard criteria' and are included in the descriptive statistics in tables 7.1 to 7.4; 46.2% (417) 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').

Due to limited cell sizes (less than 30) for children aged 4 to 6 years descriptive statistics for sodium and estimated salt intakes are presented only in accordance with the 'complete by claim only' criterion. It should also be noted that as cell sizes for child age groups are limited, caution should be taken when interpreting the data for children aged 4 to 18 years.

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. [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).

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).

7.4.2 Alternative criterion for classifying complete collections from children aged 4 to 10 years

Children aged 4 to 10 years are more likely to have difficulty swallowing tablets than older participants so compliance with the PABA protocol is likely to be poorer in this age group, particularly at the younger end of the age range. Therefore, an alternative criterion was used for children to determine which collections could be regarded as 'complete', for collections not deemed complete by the PABA protocol. This alternative child criterion was when the collections were claimed to include all urine passed for 23 to 25 hours from the start time irrespective of PABA excretion. Results based on urine collections deemed complete by this alternative child (claim only) criterion are tabulated separately in 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 urinary estimated salt intake per 24 hours. Tables 7.1-7.4 provide data for children aged 4 to 6 years and 7

to 10 years (sex combined only), and children aged 11 to 18 years and adults aged 19 to 64 years and 65 years and over, 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 6 years in Scotland.

For all age/sex groups, except for women aged 65 years and over, mean estimated salt intake was higher than the maximum recommended intake for each age group.[11,12]

Adult males had higher mean urinary sodium excretion per 24 hours (and estimated salt intake) than their female counterparts. As expected, mean urinary sodium excretion (and estimated salt intake) was higher in the 19 to 64 years and 65 years and over age group than in the 4 to 18 years age group and in children increased with age from 7 to 10 years to 11 to 18 years.

The mean urinary sodium excretion (using the standard criteria) for children aged 7 to 10 years was 88mmol/24hr.

The mean estimated salt intake for children aged 7 to 10 years (complete by standard criteria) was 5.1g/day; 2% greater than the SACN recommendation of a population average of no more than 5g/day.[11,12] The population distribution was skewed towards higher values; the median estimated salt intake for children aged 7 to 10 years was 5.0g/day.

The mean urinary sodium excretion for children aged 11 to 18 years was 118mmol/24hr for boys and 125mmol/24hr for girls.

The mean estimated salt intake for children aged 11 to 18 years was 7.1g/day, this was 18% greater than the SACN recommendation of a population average of no more than 6g/day. Boys had a mean daily intake of 6.9g/day and girls had a mean daily intake 7.3g/day. The population distribution was heavily skewed towards higher values; the median estimated salt intake for children aged 11 to 18 years was 6.8g/day (boys 6.3g/day, girls 7.0g/day).

Mean urinary sodium excretion was 170mmol/24hr for men aged 19 to 64 years and 126mmol/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 44% greater than the SACN recommendation of a population average of no more than 6g/day. Men had a daily intake of 9.9g/day and women had a mean daily intake 7.4g/day. The population distribution was heavily skewed towards higher values; the median estimated salt intake for the adult population was 7.8g/day (men 9.0g/day, women 7.0g/day).

Mean urinary sodium excretion was 172mmol/24hr for men aged 65 years and over and 100mmol/24hr for women aged 65 years and over. The mean estimated salt intake for adults aged 65 years and over was 7.6g/day, this was 27% greater than the SACN recommendation of a population average of no more than 6g/day. Men had a daily intake of 10.1g/day and women had a mean daily intake 5.9g/day. The population distribution was heavily skewed towards higher values for men aged 65 and over; their median estimated salt intake was 8.8g/day.

(Tables 7.1, 7.2, 7.3 and 7.4)

7.6 Comparison with previously published urinary sodium surveys in Scotland

Since this report was originally published new data have been published for salt intakes for adults in Scotland (2014).[2] 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 Scotland were last published in 2011 based on a survey carried out over approximately one year in 2009.[10] The 2009 survey estimates were based on analysis of 941 24-hour urine samples collected from a representative sample of the adult population aged 19 to 64 years in Scotland during a proportion of the period covered by the NDNS RP. The current NDNS RP has provided a mean estimate of salt intake in the population over a much longer (i.e. four year) time period (between 2008 and 2012), but with a smaller number of adult participants than the 2009 survey (255 complete samples from adults aged 19 to 64 years from Scotland in the NDNS RP[18] compared with 702 complete samples in the 2009 study). Urinary sodium excretion data for both the NDNS RP Scotland Years 1 to 4 and the Scotland 2009 sodium study were obtained using the same method in the same laboratory. The data were adjusted using a method-specific equation (i.e. multiplied by 1.052) in order to improve accuracy and to enable comparison across the different NDNS and sodium study datasets which have used different laboratory analytical methods (for information on derivation of the factor see appendix U of this report). It should be noted, however, that in the 2009 Scotland survey data from marginally incomplete collections were included in the dataset after application of an adjustment equation.[19] In contrast, in the NDNS RP dataset all collections deemed incomplete were excluded and adjustment equations were not used. The criteria for determining complete and incomplete collections were refined during NDNS RP, after the 2009 Scotland survey (see appendix T).

Both sets of data indicate that during the period the surveys covered, the average estimated salt intake in Scotland exceeded the maximum recommended salt intake of 6g per day for adults. The results from NDNS RP samples collected in Scotland suggest a slightly lower average salt intake over the four-year period of the NDNS RP compared to the shorter period covered by the 2009 survey in Scotland (fieldwork was carried out in 2009 and early 2010) for both men (9.9g per day versus 10.5g per day) and women (7.4g per day versus 8.1g per day).[20,21] Interpretation of this comparison needs to be cautious given the differences in the methodology described above.

A new urinary survey in Scotland in 2014 published in 2016[2] provides data to help determine whether there has been a decrease in salt intakes in Scotland since 2009.[10,22]

7.7 Comparison with the previous urinary sodium survey in England

Since this report was originally published new data have been published for salt intakes for adults in England (2014).[1] 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,[9,23] 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 mean estimated salt intake for adults aged 19 to 64 years in England in 2011[23] (8.5g per day) was similar to the NDNS RP in Scotland 2008/09-2011/12 (8.6g per day). Results for men (9.8g per day versus 9.9g per day in Scotland) and women (7.2g per day versus 7.4g per day in Scotland) were also similar.

The urinary sodium survey of adults in 2014 in Scotland which ran concurrently with a urinary sodium survey in England, allows comparison of estimated salt intakes between the two countries.[1,2]

7.8 Comparison with the UK NDNS RP estimated salt intakes

The mean estimated salt intake for children aged 7 to 10 years (complete by standard criteria) in the NDNS RP in Scotland (5.1g per day) was similar to the UK NDNS RP (5.3g per day). Results for children aged 11 to 18 years in Scotland and the UK were also similar with intakes of 7.1g and 7.0g per day respectively. The mean estimated salt intake for children aged 7 to 10 years in Scotland was 2% greater than the SACN recommendation of a population average of no more than

5g/day and in the UK was 6% greater than the SACN recommendation.[11,12] The mean estimated salt intake for children aged 11 to 18 years in Scotland was 18% greater than the SACN recommendation of a population average of no more than 6g/day and in the UK was 16% greater than the SACN recommendation.[11,12]

Results for older adults in Scotland were similar to those in the UK. The mean estimated salt intake for adults aged 65 years and over in the NDNS RP in Scotland and the UK NDNS RP was 7.6g per day. For adults aged 65 years and over the mean estimated salt intake in Scotland was 27% greater than the SACN recommendation of a population average of no more than 6g/day and in the UK was 26% greater than the SACN recommendation.[11,12]

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[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;

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

[12] 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).

[13] 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.

[14] 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

[15] The SDGs describe the diet that will improve and support the health of the Scottish population and are used to assist with policy development to reduce the burden of obesity and diet-related disease in Scotland. Revised Dietary Goals for Scotland. Scottish Government, May 2013; http://www.scotland.gov.uk/Resource/0042/00421385.pdf (accessed 22/10/15).

[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] Whilst the NDNS RP obtained urine collections from participants aged four years and over, for the purposes of comparing the number of complete urine collections in the NDNS RP with those in the 2011 Scotland sodium study, the number presented here is only for 19 to 64 year olds. The total number of complete urine collections for the NDNS RP for those aged four years and over was 485.

[19] 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.

[20] Urine sodium for the two studies was measured concurrently, in the same laboratory and with the same method.

[21] The uncorrected means in the Scotland 2009 report were 10.0g/day for men aged 19 to 64 years and 7.8g/day for women aged 19 to 64 years. The corrected values presented in this chapter were used for the trend analysis carried out in the Scotland 2014 sodium report published in 2016; 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).

[22] Sodium measurement and selection of complete urine collections from the 2014 urinary sodium survey followed the same methods as the NDNS RP, to facilitate comparisons.

[23] 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).

8 Detailed age breakdowns for young people and adults in Scotland for key nutrients and disaggregated foods and comparisons to the UK

Elizabeth Stickley, Caireen Roberts, Nida Ziauddeen, David Pell, Toni Steer, Sonja Nicholson, Alison Lennox and Polly Page

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

In the first publication of this report (in September 2014), 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 Scotland 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 those 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 for both Scotland and the UK to allow comparison between the Scotland sample and the UK sample. Results are also subdivided by sex for these age groups. 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 these particular age groups within Scotland, and between Scotland and the UK have not been tested for statistical significance.[1]

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 Scottish Dietary Goals (SDGs)[2] which provide the foundation for diet and health policy in Scotland relate to the current UK recommendations for food and nutrient intake.[3]

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 the other components of these dishes).[4] In addition, results for consumption of 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet'[5] are also presented as they represent key foods that are included as part of a set of indicators set by the Scottish Government to monitor progress against the actions set out in the Scottish Obesity Route Map,[6,7] and more recently as part of Supporting Healthy Choices: a framework for voluntary action,[8] in order to reduce population energy intake in Scotland. A definition of all the categories of foods included in Tables 8.6 and 8.7 is provided in Appendix R of this report. The values in these tables refer to mean values for the total NDNS RP population in Scotland, 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 between Scotland and the UK and with the SDGs.[2,3,9]

- Mean daily intakes of food energy were similar for males and similar or slightly lower for females between Scotland and the UK across the four age groups. Total energy showed a similar pattern but was higher in Scotland for the 16 to 24 year old males.

- Mean intakes of total fat as a percentage of food energy were similar for all four age groups between the Scotland and the UK with the exception of the 50 to 64 years old age group where mean intakes in Scotland were higher than the equivalent age groups for the UK (35.8% compared with 34.8%). Mean intakes met the SDG of contributing no more than 35% of food energy in all age/sex groups apart from men and women in the 50 to 64 years age group, for whom mean intakes were 36.0% and 35.5% of food energy respectively.

- Mean saturated fatty acids intakes as a percentage of food energy in Scotland were similar or slightly higher in Scotland than in the UK for males and females. Mean daily intakes of saturated fatty acids exceeded the SDG of providing no more than 11% of food energy in all age/sex groups. Mean intakes for males and females combined ranged from 12.3% in those aged 16 to 24 years to 13.6% in those aged 50 to 64 years.

- Mean *trans* fatty acid intakes as a percentage of food energy were similar for the Scotland and the UK sample in all four sex-combined age groups. Mean intakes met the SDG of remaining below 1% of food energy in all age/sex groups.[10]

- Mean intakes of non-milk extrinsic sugars (NMES) as a percentage of food energy were similar between Scotland and the UK for the male age groups with the exception of males aged 16 to 24 years where intakes were higher in Scotland (15.1% versus 14.4%) and for those aged 50 to 64 years where intakes were lower in Scotland (10.8% versus 11.7%). Intakes were similar for all female age groups in Scotland compared to the UK with the exception of the 16 to 24 year olds where intakes were lower in Scotland (13.2% versus 15.8%). Mean intakes did not meet the SDG of providing less than 11% of food energy in all age/sex groups, except for men and women aged 50 to 64 years, where intakes were 10.8% and 10.5% of food energy respectively. Mean intakes were highest in the youngest male age group, at 16.1% of food energy for those aged 11 to 15 years.

- Mean intakes of non-starch polysaccharide (NSP) were slightly lower in Scotland for all four age groups compared to the UK for both males and females. Mean intakes increased with age, ranging from 11.2g for those aged 11 to 15 years to 13.4g for those aged 50 to 64 years. Mean intakes of NSP did not meet the SDG which is set at a population average intake of 18g per day.

(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 the Scotland sample (including non-consumers). The numbers of reported consumers were too low in the younger age groups to provide meaningful data. Consumers are those who reported consumption of alcoholic beverages in the four-day food diary.[11]

In the Years 1 to 4 combined data, weekend days are slightly over-represented and this should be taken into account when interpreting findings on alcohol intake (see Chapter 5, section 5.1, Table 5A). Cell sizes for males and females aged 16 to 24 years and 50 to 64 years are small and this should be borne in mind when interpreting the data.

Mean intakes (including non-consumers) were similar between Scotland and the UK across all age groups apart from males aged 16 to 24 years who had a higher percentage of total energy from alcohol compared to the UK (6.9% compared with 3.0%). The highest mean intakes in Scotland were for males aged 50 to 64 years for whom alcohol intakes provided 7.3% of total energy.

(Tables 8.2a-8.2c)

8.4 Vitamins and minerals

This section presents daily intakes of selected vitamins and minerals for the Scotland 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).[12] The proportions of participants with intakes below the Lower Reference Nutrient Intakes (LRNIs)[13] are also shown. The RNIs and LRNIs for the vitamins and minerals presented are shown in Tables 5.14 and 5.32 (Chapter 5).

For males, mean intakes in all age groups met or were close to meeting the RNI for the selected vitamins and minerals. For females, mean iron intakes were below the RNI for those aged 11 to 15 years (56% of the RNI), 16 to 24 years (59% of the RNI) and 25 to

49 years (65% of the RNI). Mean calcium and folate intakes did not meet the RNI for girls aged 11 to 15 years (both 88% of the RNI).

For males in all age groups, the proportion with intakes below the LRNI was low for iron, calcium, vitamin C and folate in Scotland and the UK. The highest proportion was for iron in boys aged 11 to 15 years in Scotland, where 9% were below the LRNI, compared with 6% in the UK.

A greater proportion of females compared with males had intakes of micronutrients which fell below the LRNI in Scotland and the UK. The proportion with iron intakes below the LRNI were similar between Scotland and the UK with the exception of females aged 11 to 15 years in Scotland where 55% were below the LRNI compared to 44% in the UK. In the 16 to 24 year age group the proportion below the LRNI was similar for females in Scotland and in the UK (42% and 40% respectively). There was no difference in the proportion of females aged 25 to 49 years in Scotland and the UK with an iron intake below the LRNI (29% for both Scotland and the UK).

There was a slightly lower proportion of females aged 11 to 15 years in Scotland with intakes of calcium below the LRNI compared to the UK (12% versus 18%), in contrast, females aged 50 to 64 years in Scotland had a slightly higher proportion below the LRNI compared to the UK (11% versus 7%).

Eleven per cent of girls aged 11 to 15 years in Scotland had intakes below the LRNI for folate, which was a slightly higher proportion than for the UK (7%). However fewer (3%) females aged 16 to 24 years in Scotland had folate intakes below the LRNI compared to the UK (9%).

For vitamin D, RNIs are only set for those aged up to 4 years and those aged 65 years and over, discussion for these age groups can be found in Chapter 5. Intakes of vitamin D increased slightly across the four age groups in Scotland and were generally similar to the UK.

(Tables 8.3a-8.5c)

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

This section reports on consumption of vegetables, fruit, meat and fish based on disaggregated data for the Scotland sample. This includes the contribution from composite dishes (both homemade dishes and manufactured products), but excludes the other components of those dishes.[4] 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,[14] 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 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 for total fruit and vegetables combined (excluding fruit juice), intakes were slightly lower in Scotland compared to the UK for all age groups. Mean total vegetable consumption (not including potatoes) increased with age from 93g per day for those aged 11 to 15 years to 172g per day for those aged 50 to 64 years. Mean total fruit intake (not including juice) was lowest in the 16 to 24 years age group (56g per day) and highest in the 50 to 64 years age group (114g per day).

The proportion of males achieving "5-a-day" was lower for all age groups in Scotland compared to the UK with the exception of males aged 11 to 15 years where the proportion was about the same. The proportion of females achieving "5-A-Day" in Scotland was similar to the UK in the two younger age groups but slightly lower in the two older age groups, with 24% compared with 26% of females aged 25 to 49 years and 32% compared with 39% of females aged 50 to 64 years achieving "5-A-Day" in Scotland compared with the UK sample. The average number of portions consumed by males and females combined, calculated using the "5-A-Day" criteria[14] also increased with age from 2.6 portions per day for those aged 11 to 15 years to 4.1 portions per day for those aged 50 to 64 years. The proportion of participants achieving "5-A-Day" increased with age ranging from 9% for those aged 11 to 15 years to 31% for those aged 50 to 64 years.

Consumption of red meat based on disaggregated data (which includes processed meat) was slightly higher in Scotland than the UK for males in all four age groups except for those aged 11 to 15 years (63g compared with 69g). For females, consumption of red meat was similar between Scotland and the UK for all four age groups. Mean consumption of red meat was lowest in those aged 11 to 15 years (53g per day) and highest in those aged 50 to 64 years (76g per day). The current SDG is that average intakes of red and processed meat should be pegged at around 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.[2] While mean intakes for females in all age groups met the recommendation, mean intakes for males exceeded it in all age groups except those aged 11 to 15 years, with those aged 16 to 24 years having the highest intake of red meat (98g per day).

Consumption of oily fish was far below the SDG of one portion (140g) per week[15] in all four age groups. For those aged 50 to 64 years, consumption of oily fish was slightly lower in Scotland compared with the UK (equivalent to 60g versus 76g per week respectively), although these differences are unlikely to be of nutritional importance given the low intakes. On average oily fish consumption was equivalent to 20g per week for those aged 11 to 15 years, 30g per week for those aged 16 to 24 years, 38g per week for those aged 25 to 49 years and 60g per week for those aged 50 to 64 years.[16]

(Tables 8.6 a-c)

8.6 Indicator foods and drinks high in fat and sugar

Food and drinks high in fat and sugar,[6,7] including 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet'[5] have been targeted for population level reduction in Scotland.[6,7,8] Results are provided for the total Scotland sample, including non-consumers (i.e. those who did not consume from a food group during the four-day diary recording period).

- Mean consumption of 'biscuits', 'buns, cakes and pastries' and 'confectionery' showed no consistent pattern between Scotland and the UK for all four age groups. Mean consumption of 'soft drinks, non-diet'[5] was consistently higher in Scotland compared to the UK for all age groups except for those aged 50 to 64 years.

- Mean consumption of 'biscuits' in males was similar for all age groups, however, for females, consumption was highest in the 50 to 64 years age group (17g per day) and lowest in the 16 to 24 years age group (8g per day).

- Mean consumption of 'buns, cakes and pastries' was similar for all male age groups, however, for females, mean consumption ranged from 19g per day for those aged 11 to 15 years to 11g per day for those aged 16 to 24 years.

- Mean consumption of 'confectionery' for males was highest for those aged 11 to 15 years (22g per day) and lowest in those aged 50 to 64 years (7g per day). For females, mean consumption was also highest in the 11 to 15 years age group (20g per day) and 10g or 11g per day in the other age groups.

- Mean consumption of 'soft drinks, non-diet'[5] for both males and females was highest in those aged 16 to 24 years (366g per day and 224g per day respectively). Mean consumption of 'soft drinks, non-diet'[5] was lowest in both males and females aged 50 to 64 years (82g per day and 53g per day respectively).

(Tables 8.7 a-c)

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[1] It should be noted that for some dietary variables the UK values in this Scotland 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.

[2] Revised Dietary Goals for Scotland. http://www.scotland.gov.uk/Resource/0042/00421385.pdf (accessed 08/08/14).

[3] 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.

[4] For the NDNS RP, 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.

[5] See Appendix R of this report for a full definition (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R).

[6] http://www.scotland.gov.uk/Publications/2011/03/17104639/1 (accessed 08/08/14).

[7] http://www.scotland.gov.uk/Publications/2011/03/17104457/2 (accessed 08/08/14).

[8] Supporting Healthy Choices: A Framework for Voluntary Action. http://www.scotland.gov.uk/Publications/2014/06/8253 (accessed 08/08/14).

[9] 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 people in the group.

[10] It should be noted that the SDG for *trans* fatty acid intakes is different from the UK recommendation that trans fat intakes should not exceed 2% of food energy.

[11] Consumers also include those who consumed alcohol in recipe dishes and other foods.

[12] 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.

[13] 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.

[14] http://www.nhs.uk/Livewell/5ADAY/Pages/5ADAYhome.aspx (accessed 08/08/14).

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

[16] 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 and the Scottish Index of Multiple Deprivation (SIMD) quintiles for key nutrients and disaggregated foods

Toni Steer, Caireen Roberts, Sonja Nicholson, David Pell, Nida Ziauddeen, Polly Page and Alison Lennox

Erratum note: Correction to fruit and vegetable consumption estimates, including from composite dishes (section 9.4 and 9.7)

In the first publication of this report (in September 2014), 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 by participants in Scotland in Years 1 to 4 combined of the NDNS Rolling Programme (RP) by equivalised household income (section 9.2) and by the Scottish Index of Multiple Deprivation (SIMD) (section 9.3).[1]

Results are presented for males and females combined for the standard age groups; 4 to 10 years, 11 to 18 years and 19 to 64 years and subdivided into quintiles. 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 Scotland aged 1.5 to 3 years and 65 years and over were too small to be subdivided into quintiles and are therefore not presented in this chapter.

In this chapter, the nutrient intakes presented have been limited to key macronutrients and micronutrients of policy interest and are described from food sources only (not including supplements). The Scottish Dietary Goals (SDGs)[2] provide the foundation for diet and health policy in Scotland and relate to the current UK recommendations for food and nutrient intakes.[3]

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 the other components of these dishes).[4] In addition, mean consumption of 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet'[5] are also presented as they represent key foods that have been targeted for reduction in Scotland and are included as part of a set of indicators set by the Scottish Government to monitor progress against the actions set out in the Scottish Obesity Route Map[6,7] and more recently as part of Supporting Healthy Choices: a framework for voluntary action,[8] in order to reduce population energy intakes. A definition of all the categories of foods included in Tables 9.6, 9.7, 9.13 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 Scotland, 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.[9] Equivalised income quintile 1 is the group with the lowest equivalised household income and quintile 5 is the group with the highest equivalised household income.

SIMD identifies small areas of multiple deprivation across Scotland using a consistent approach to enable the effective targeting of government policies. SIMD ranks areas from most deprived (ranked 1) to least deprived (ranked 6,505). In this chapter, the areas have been split into quintiles, with quintile 1 containing the most deprived areas and quintile 5 containing the least deprived areas. A more detailed explanation of SIMD is provided on the Scottish Government website.[10]

Statistical analysis has been carried out for this chapter to separately compare equivalised income quintiles and SIMD quintiles to the respective reference quintile group only. In both cases, the highest group (quintile 5) 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 quintiles highlighting any patterns, for example where there is an increase or decrease across the quintiles and any statistically significant differences. Not all statistically significant differences are described in the text, especially where there is no clear pattern by quintile, however, all statistically significant differences are annotated in the 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 for children aged 4 to 10 years split by equivalised income as the reference group (quintile 5) in this age group has less than 50 cases. Numbers are low in some quintile groups; therefore caution should be exercised when interpreting findings. In addition, due to rounding some values appear the same in the tables, however, the values are different once they are presented to further decimal places. For ease of reading, the term 'equivalised household income quintile' has been abbreviated throughout the chapter to 'income quintile'.

9.2 Comparison of equivalised household income quintiles 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. Mean daily intakes of macronutrients are compared with the SDGs and UK DRVs.[2,3]

- No clear pattern was observed for mean daily intakes of total or food energy between income quintiles in any age group.

- Overall no clear pattern was observed for mean total fat or saturated fatty acids intakes between income quintiles, either when expressed as a percentage of food energy intake or in terms of absolute intake (grams per day) in any age group.

- Overall, no clear patterns were observed in mean intake of *trans* fatty acids as a percentage of food or total energy or in terms of absolute intake (grams per day). As a percentage of food energy, all age groups had mean intakes that met the SDG of remaining below 1% of food energy intake.[11]

- In adults aged 19 to 64 years mean protein intake as a percentage of food energy increased from income quintile 1 to income quintile 5 and was significantly lower in income quintiles 1 (16.2%) and 2 (16.4%) compared with income quintile 5 (17.8%).

- No clear patterns were observed in mean intakes of total carbohydrate between income quintiles in any age group either when expressed as a percentage of food or total energy intakes or in terms of absolute intake (grams per day).

- No clear pattern was observed in mean intake of non-milk extrinsic sugars (NMES) between income quintiles either as a percentage of food or total energy

intake or in terms of absolute intake (grams per day) in children aged 11 to 18 years. However, in adults aged 19 to 64 years, NMES intake as a percentage of food energy was significantly higher in income quintile 1 (13.5%) compared with income quintile 5 (10.6%). The only group to meet the SDG for NMES intake, to reduce to less than 11% of food energy, was adults aged 19 to 64 years in income quintile 5.

- For non-starch polysaccharides (NSP) children aged 11 to 18 years had a mean intake which was significantly lower in income quintiles 1 (10.4g) and 2 (11.5g) compared with income quintile 5 (12.9g). Mean intake of NSP increased from income quintiles 1 and 2 through to 5 in adults aged 19 to 64 years and was significantly lower in quintiles 1 (11.4g), 2 (11.4g), 3 (12.9g) and 4 (13.5g) compared with intake in income quintile 5 (14.7g).

(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 intake by consumers only. In the Years 1 to 4 combined data, there remains a slight over-representation of weekend days compared with weekdays and this should be taken into account when interpreting findings on alcohol intake (see section 5.1, Table 5A).

No clear patterns were observed for alcohol intake in children aged 11 to 18 years or adults aged 19 to 64 years by income quintile, either as a percentage of total energy or in terms of absolute intake (grams per day).

(Table 9.2)

9.3 Vitamins and minerals by equivalised household income

This section presents daily intakes of selected vitamins and minerals, namely vitamin D, vitamin C, folate, iron and calcium, from food sources only (excluding dietary supplements) and compares them with the Reference Nutrient Intakes (RNIs).[12] The proportions of participants with intakes below the Lower Reference Nutrient Intakes (LRNIs)[13] are also 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 adults aged 19 to 64 years was significantly lower in income quintiles 1 (10.1mg), 2 (9.7mg) and 3 (10.4mg) compared with income quintile 5 (11.3mg). In children aged 11 to 18 years, mean intake in income quintile 1

(8.5mg) was significantly lower than in income quintile 5 (10.3mg). Mean intake of iron as a percentage of the RNI for children aged 4 to 10 years and adults aged 19 to 64 years was above 90% of the RNI in all income quintiles. Children aged 11 to 18 years had a mean intake of iron which was below 90% of the RNI in all income quintiles, with mean intake in income quintile 1 (68%) being significantly lower than in income quintile 5 (82%). In both the 11 to 18 years and 19 to 64 years age groups, a higher proportion of those in the lower income quintiles had iron intakes below the LRNI than in the higher income quintiles. However these differences were not significant. In children aged 11 to 18 years the percentage below the LRNI ranged from 39% in income quintile 1 to 23% in income quintile 5 and in adults 19 to 64 years from 19% and 21% in income quintiles 1 and 2 respectively to 9% in income quintile 5.

- No clear pattern was observed for mean daily calcium intake. All age groups and income quintile groups had mean daily intakes of calcium greater than 90% the RNI with the exception of children aged 11 to 18 years in income quintiles 1, 3 and 4 where the mean daily intake was 82%, 89% and 86% of the RNI respectively. In children aged 11 to 18 years, a higher proportion of those in income quintiles 1 (21%) and 2 (16%) had intakes below the LRNI compared with those in income quintile 5 (12%). A higher proportion of adults aged 19 to 64 years in income quintiles 1 (12%) and 2 (12%) had calcium intakes below the LRNI compared with those in the same age group in income quintile 5 (3%), however these differences were not significant.

- Children aged 11 to 18 years in income quintile 1 (56.0mg) had a significantly lower mean intake of vitamin C compared with those in the same age group in income quintile 5 (87.8mg). In adults aged 19 to 64 years mean intake was significantly lower in income quintiles 1 (52.5mg), 2 (55.5mg) and 3 (73.6mg) compared with intake in income quintile 5 (98.5mg). Mean vitamin C intakes were above the RNI in all income quintiles and for all age groups.

- Mean vitamin D intake in children aged 11 to 18 years was significantly lower in income quintiles 1 (1.8μg), 3 (1.9μg) and 4 (1.8μg) compared with income quintile 5 (2.6μg).

- Children aged 11 to 18 years in income quintiles 1 (179μg), 2 (201μg) and 4 (204μg) had a significantly lower mean intake of folate compared with those in income quintile 5 (244μg). In adults aged 19 to 64 years, mean intake was significantly lower in income quintiles 1 (226μg), 2 (208μg) and 3 (245μg) compared with intake in income quintile 5 (281μg). Mean folate intake was 90% of the RNI or more in all age groups and income quintiles. The proportion of children aged 11 to 18 years with intakes of folate below the LRNI ranged from 2% to 11% but there was no pattern by income quintile.

(Tables 9.3 – 9.5)

9.4 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.[4] 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 (excluding fruit juice) in children aged 11 to 18 years and adults aged 19 to 64 years increased from the lowest to the highest income quintile. Mean consumption of total fruit and vegetables was significantly lower in income quintiles 1 (131g), 2 (160g) and 4 (165g) than in income quintile 5 (197g) for children aged 11 to 18 years. In adults aged 19 to 64 years mean consumption of total fruit and vegetables was significantly lower in income quintiles 1 (174g), 2 (193g), 3 (241g) and 4 (271g) than consumption in income quintile 5 (325g).

- Mean consumption of "5-a-day" fruit and vegetable portions was significantly lower in income quintile 1 and 2 compared to income quintile 5 in children aged 11 to 18 years. In adults aged 19 to 64 years there was a pattern of increasing fruit and vegetable portion consumption from income quintile 1 to income quintile 5. Children aged 11 to 18 years in income quintiles 1 (2.1 portions per day) and 2 (2.6 portions per day) had significantly lower mean consumption of "5-A-Day" fruit and vegetable portions compared with income quintile 5 (3.2 portions per day). Adults aged 19 to 64 years in income quintiles 1 (2.7 portions per day), 2 (2.9 portions per day), 3 (3.6 portions per day) and 4 (3.9 portions per day) had significantly lower mean consumption of "5-A-Day" compared with those in income quintile 5 (4.7 portions per day).

- The percentage of children aged 11 to 18 years achieving "5-A-Day" fruit and vegetable portions was significantly lower in income quintile 1 (1%) compared with income quintile 5 (12%). The percentage of adults aged 19 to 64 years achieving "5-A-Day" was significantly lower in income quintiles 1 (14%), 2 (12%) and 3 (23%) compared with income quintile 5 (37%).

- No clear pattern by income was observed in mean total meat or mean red meat consumption across income quintiles in any age group.

- No clear pattern was observed in mean total fish or oily fish consumption for any age group.

(Table 9.6)

9.5 Indicator foods and drinks high in fat and sugar by equivalised income

Food and drinks high in fat and sugar,[6,7] including 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet'[5] have been targeted for population level reduction in Scotland. Results are provided for the total sample, including non-consumers (i.e. those who did not consume from a food group during the four-day diary recording period).

- No clear pattern was observed in mean consumption of 'biscuits', 'buns, cakes and pastries' or 'confectionery' in any of the child and adult age group by income quintile.

- Mean consumption of 'soft drinks, non-diet'[5] was significantly higher in quintile 1 compared with quintile 5 for children aged 11 to 18 years (307g compared with 280g) and adults aged 19 to 64 years (249g compared with 80g).

(Table 9.7)

9.6 Comparison of Scottish Index of Multiple Deprivation (SIMD) quintiles for key nutrients and disaggregated foods

9.6.1 Energy and key macronutrient intake by SIMD

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 SIMD quintile with quintile 1 containing the most deprived areas of Scotland and quintile 5 containing

the least deprived areas of Scotland. A definition of SIMD is provided in section 9.1 of this chapter. Mean daily intakes of macronutrients are compared with the SDGs and UK DRVs[2,3] for age groups 4 to 10 years, 11 to 18 years and 19 to 64 years, sex combined.

- In all age groups, no clear pattern in mean daily intakes of total or food energy was observed between SIMD quintiles.

- Overall, no clear pattern was observed in any age group for mean total fat intakes between SIMD quintiles, either when expressed as a percentage of food energy intake or in terms of absolute intake (grams per day).

- No clear pattern was observed for mean saturated fatty acids intakes as a percentage of food energy or in terms of absolute intakes (grams per day) for any age group. All age groups had mean saturated fatty acids intakes that were 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 nor in terms of absolute intake (grams per day). As a percentage of food energy, all age groups in all SIMD quintiles had mean intakes that met the SDG of remaining less than 1% of food energy intake.

- For children aged 4 to 10 years, mean protein intake expressed as a percentage of food energy was significantly lower in SIMD quintiles 1 (13.7%) and 3 (14.1%) compared with intake in SIMD quintile 5 (15.1%). For children aged 11 to 18 years and adults aged 19 to 64 years, although there were some significant differences by quintile there was no clear pattern.

- Overall, no clear pattern was observed in mean intakes of total carbohydrate by SIMD quintile when expressed as a percentage of food energy intake or in terms of absolute intake (grams per day) for all age groups.

- Overall, no clear pattern was observed in mean intake of NMES as a percentage of food energy intake or in terms of absolute intake (grams per day) for children aged 4 to 10 years and 11 to 18 years. Intake of NMES, expressed as a percentage of food energy in adults aged 19 to 64 years was significantly higher in SIMD quintile 1 (13.0%) compared with SIMD quintile 5 (11.0%).

- For NSP, children aged 11 to 18 years and adults aged 19 to 64 years had a mean intake which was significantly lower in SIMD quintile 1 (10.2g and 11.1g respectively) compared with SIMD quintile 5 (12.1g and 13.8g respectively).

(Table 9.8)

9.6.2 Alcohol intake by SIMD

This section reports on alcohol intakes in grams per day and as a percentage of total energy for the total sample (including non-consumers). In the Years 1 to 4 combined data, there is a slightly higher proportion of weekend days than weekdays and this should be taken into account when interpreting findings on alcohol intake (see section 5.1, Table 5A).

No statistically significant differences in mean alcohol intakes between SIMD quintiles was observed in any age group. However, children aged 11 to 18 years and adults aged 19 to 64 years had a mean alcohol intake in grams and as a percentage of total energy that was higher in SIMD quintile 5 (least deprived areas) compared with all other quintiles. Numbers were too small to report intakes for consumers only.

(Table 9.9)

9.6.3 Vitamins and minerals by SIMD

This section presents daily intakes of selected vitamins and minerals, namely vitamin D, vitamin C, folate, iron and calcium, from food sources only (excluding dietary supplements) and compares them with the UK RNIs[12] and the proportions of participants with intakes below the LRNIs[13] 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 was significantly lower in SIMD quintile 1 (8.8mg) compared with SIMD quintile 5 (9.9mg). Mean iron intake in adults aged 19 to 64 years was significantly lower in SIMD quintile 1 (9.6mg) compared with SIMD quintile 5 (10.9mg). Mean intake of iron as a percentage of the RNI for children aged 4 to 10 years and adults aged 19 to 64 years were above 90% of the RNI in all SIMD quintiles. Children aged 11 to 18 years had a mean intake of iron which was below 90% of the RNI in all SIMD quintiles, but no significant differences were observed in any of these SIMD quintiles compared to SIMD quintile 5. Between 21% and 34% of children aged 11 to 18 years in all SIMD quintiles and 17% of adults aged 19 to 64 years in SIMD quintiles 1 and 2 and 14% in SIMD quintile 3 had intakes of iron below the LRNI. No clear pattern of difference between SIMD quintiles was observed.

- No clear patterns were observed for mean daily calcium intakes. All age groups and SIMD quintile groups had mean daily intakes of calcium greater than 90% the RNI with the exception of children aged 11 to 18 years in SIMD quintiles 1 and 2 where the mean daily intake was 79% and 85% of the RNI. In this age group, mean intake in SIMD quintile 1 (79% of the RNI) was significantly lower than the mean intake in SIMD quintile 5 (90% of the RNI). There was no pattern by SIMD quintile in the percentage below the LRNI for those aged 11 to 18 years,

16% of SIMD quintile 1 fell below the LRNI compared with 14% of SIMD quintile 5.

- Mean vitamin C intakes, for all age groups were significantly lower in SIMD quintile 1 compared with the mean intake in SIMD quintile 5. Mean vitamin C intakes were greater than the RNI in all SIMD quintiles for all age groups.

- No clear pattern for mean vitamin D intakes were observed in any age group. No significant differences across SIMD quintiles in any age group were observed.

- In children aged 11 to 18 years mean folate intake was significantly lower in SIMD quintile 1 (176µg) compared with SIMD quintile 5 (219µg). In adults aged 19 to 64 mean folate intake was significantly lower in SIMD quintile 1 (211µg) compared with SIMD quintile 5 (267µg). Mean folate intakes were greater than 90% of the RNI in all age groups and SIMD quintiles with the exception of children aged 11 to 18 years in SIMD quintile 1. In this group mean folate intake was 88% of the RNI and was significantly lower than intake in SIMD quintile 5 (110% of the RNI). In this age group, 17% of those in SIMD quintile 1 had an intake of folate which was below the LRNI.

(Tables 9.10 - 9.12)

9.7 Vegetables, fruit, meat and fish consumption, including from composite dishes, by SIMD

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, but excludes the other components of those dishes.[4] 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 (excluding fruit juice) in children aged 4 to 10 years was significantly lower in SIMD quintile 1 (136g) compared with SIMD quintile 5 (195g). Mean total fruit and vegetable consumption in children aged 11 to 18 years was significantly lower in SIMD quintile 1 (131g) compared with SIMD quintile 5 (192g). Total fruit and vegetable consumption for adults aged 19 to 64 years increased from SIMD quintile 1 to 5 and was significantly lower in SIMD quintile 1 (176g) compared with consumption in SIMD quintile 5 (289g).

- Mean consumption of "5-A-Day" fruit and vegetable portions for children aged 11 to 18 years and adults aged 19 to 64 years was significantly lower in SIMD quintile 1 (2.3 portions per day and 2.6 portions per day) compared with those in SIMD quintile 5 (3.0 portions per day and 4.2 portions per day).

- The percentage of children aged 11 to 18 years and adults aged 19 to 64 years achieving "5-A-Day" was significantly lower in SIMD quintile 1 (2% and 12%) compared with SIMD quintile 5 (13% and 32%).

- No clear pattern by SIMD was observed in mean total meat or mean red meat consumption in any age group.

- No clear pattern was observed in mean total fish or oily fish consumption for any age group.

(Table 9.13)

9.7.1 Indicator foods and drinks high in fat and sugar by SIMD

Foods and drinks high in fat and sugar,[6,7] including 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet'[5] have been targeted for population level reduction in Scotland. Results are provided for the total sample, including non-consumers (i.e. those who did not consume from a food group during the four-day diary recording period).

- Children aged 4 to 10 years had a significantly lower mean consumption of 'biscuits' in SIMD quintiles 1 (12g) and 2 (11g) compared with those in SIMD quintile 5 (21g).

- Mean consumption of 'buns, cakes and pastries' in children aged 11 to 18 years was significantly lower in SIMD quintiles 1 (12g), 2 (9g), 3 (15g) and 4 (18g) compared with SIMD quintile 5 (23g). Adults aged 19 to 64 years in SIMD quintile 1 (10g) had a significantly lower consumption than SIMD quintile 5 (16g).

- Mean consumption of 'confectionery' showed no clear pattern in any age group.

- Mean consumption of 'soft drinks, non-diet'[5] showed no clear pattern in any age group, except those aged 4 to 10 years where mean consumption decreased from the most deprived to the least deprived SIMD quintile, although this was not significant.

(Table 9.14)

9.8 Summary of main findings by equivalised household income and SIMD

There were some observed differences in food consumption, energy and nutrient intakes by equivalised household income quintiles and SIMD quintiles. Differences tended to be clearest between the lowest and highest quintiles and analysis by equivalised income and SIMD generally showed consistent results. However, differences between quintiles were not consistently seen for all age groups.

Overall, there were no clear differences by equivalised household income or SIMD for energy intake or macronutrients. The exceptions being protein (equivalised income only), where adults aged 19 to 64 years in the lowest quintile had a lower mean intake as a percentage of food energy than those in the highest quintile and NMES which showed the opposite pattern. NSP intake was also lower in the lowest income/most deprived quintiles in all age groups.

Mean intake of micronutrients tended to be lower in the lower equivalised income quintiles and SIMD (most deprived) quintiles compared with the highest quintiles. However, differences only reached statistical significance for iron, vitamin C and folate. Where mean intakes were below the RNI in some age groups, for example iron, this was generally seen across all equivalised income quintiles and SIMD quintiles.

Mean fruit and vegetable consumption expressed in grams and as "5-A-Day" portions showed clear differences between quintile 1 and quintile 5 when split by equivalised income and by SIMD, with some age groups showing a pattern of increasing intake from quintile 1 to quintile 5. However, mean consumption in all quintiles was below the recommendation of "5-A-Day". No clear pattern for total meat, red meat or total fish and oily fish consumption was observed in any age group. In all age groups oily fish consumption was below the recommendation.

No clear patterns were found for indicator foods and drinks high in fat and sugar,[6,7] with the exception of mean consumption of 'soft drinks, non-diet',[5] where mean consumption in children aged 11 to 18 years and adults aged 19 to 64 years was significantly higher in the lowest income quintile compared with the highest income quintile when split by equivalised income.

[1] Analysis is based on both Scotland core cases from the UK sample and Scotland boost cases.

[2] Revised Dietary Goals for Scotland; http://www.scotland.gov.uk/Resource/0042/00421385.pdf (accessed 20/01/14)

[3] 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

[4] For the NDNS RP 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.

[5] See Appendix R of this report for a full definition (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R).

[6] http://www.scotland.gov.uk/Publications/2011/03/17104639/1 (accessed 27/01/14).

[7] http://www.scotland.gov.uk/Publications/2011/03/17104457/2 (accessed 27/01/14).

[8] Supporting Healthy Choices: A Framework for Voluntary Action
http://www.scotland.gov.uk/Publications/2014/06/8253 (accessed 27/07/14).

[9] 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.

Equivalised income adjusts income to take account of the number of persons (adults and children) in the household. Equivalised 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 aged11-12	0.25
Dependant aged13-15	0.27
Dependant aged16+	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 quintiles q1 – q5 were identified within age groups in the overall sample.
All individuals in each household were allocated to the equivalised household income quintiles to which their household had been allocated.
(Reference:McClements D.Equivalence scales for children. Journal of Public Economics 1977;8:191-210.)

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[10] http://www.scotland.gov.uk/Topics/Statistics/SIMD (accessed 10/02/14).

[11] It should be noted that the SDG for *trans* fatty acid intakes is different from the UK recommendation that trans fat intakes should not exceed 2% of food energy.

[12] 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.

[13] 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 between Scotland and the UK

Toni Steer, Caireen Roberts, Sonja Nicholson, Nida Ziauddeen, Polly Page and David Pell

Erratum note: Correction to fruit and vegetable consumption estimates including from composite dishes (section 10.5)

In the first publication of this report (in September 2014), 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 Scotland sample and the UK sample of the NDNS Rolling Programme (RP) Years 1 to 4 combined.[1,2] 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 where numbers were insufficient to subdivide by sex). Further details on the dietary data are given in Chapter 5, section 5.1.

In this chapter, the nutrient intakes have been limited to key macronutrients and micronutrients of policy interest and are described from food sources only (not including supplements). The Scottish Dietary Goals (SDGs)[3] underpin diet and health policy in Scotland and relate to the current UK recommendations for food and nutrient intakes.[4]

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 the other components of these dishes).[5] In addition, 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet',[6] are also presented as they represent key

foods that are part of a set of indicators set by the Scottish Government to monitor progress against the actions set out in the Scottish Obesity Route Map[7,8] and more recently as part of Supporting Healthy Choices: a framework for voluntary action,[9] in order to reduce population energy intake in Scotland. A definition of all the categories of foods included in Tables 10.6 and 10.7 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 in Scotland, including non-consumers.

Results were tested at the 95% significance level. Statistically significant differences are highlighted in the tables (refer to Appendix Y for a more detailed explanation of the statistical analysis). 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 of 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.

- There were no statistically significant differences in mean total or food energy intakes in Scotland compared with the UK for any of the male age groups. Total energy intake was significantly lower in women aged 19 to 64 years in Scotland compared with the UK (1559 kcals compared with 1613 kcals) and women aged 65 years and over (1435 kcals compared with 1510 kcals).

- There were no statistically significant differences in mean gram intakes of total fat, protein or total carbohydrate in Scotland compared with the UK for any age/sex group.

- There were no statistically significant differences in mean total fat intakes as a percentage of food energy between Scotland and the UK for any age/sex group. Mean intake in boys aged 4 to 10 years and men aged 19 to 64 years and 65 years and over, were slightly higher in Scotland compared to the UK, but the differences were not statistically significant.

- Generally, mean saturated fatty acids intake as a percentage of food energy was slightly higher in boys and men in Scotland compared with the UK although the differences did not always reach statistical significance. In Scotland, boys aged 4 to 10 years had a significantly higher mean intake of saturated fatty acids expressed as a percentage of food energy compared to the UK (13.6% compared with 13.1%) as did total boys aged 4 to 18 years (13.2% compared to

12.8%). For girls and women, there were differences of similar magnitude to those seen in boys and men, but not all in a consistent direction and none were statistically significant. For all age/sex groups in both Scotland and the UK, mean saturated fatty acid intakes were above the recommendation of no more than 11% of food energy from saturated fatty acids.

- For all age groups in Scotland, mean intakes of *trans* fatty acids were similar to the UK (0.6% to 0.8% of food energy). Mean intakes in Scotland met the SDG for *trans* fatty acids intakes to remain below 1% of food energy.

- There were no statistically significant differences in mean protein intakes as a percentage of food energy between Scotland and the UK for any age/sex group. Mean intake in boys aged 11 to 18 years and men aged 19 to 64 years and 65 years and over tended to be slightly lower in Scotland compared with the same age groups in the UK although the differences did not reach statistical significance.

- There was little difference between Scotland and the UK in mean total carbohydrate intakes expressed as a percentage of food energy intake across the age groups.

- There were no significant differences between Scotland and the UK in the percentage of food energy from non-milk extrinsic sugars (NMES) for any age/sex group. However, mean intake tended to be slightly higher in boys aged 4 to 18 years in Scotland compared with same age group in the UK. For girls and women the opposite was observed with girls aged 4 to 18 years and women aged 19 to 64 years in Scotland having a slightly lower percentage of food energy from NMES compared with the UK. For all age/sex groups in Scotland and the UK, mean NMES intakes were above the recommendation of no more than 11% of food energy.

- Mean non-starch polysaccharides (NSP) intakes tended to be lower in all age/sex groups in Scotland compared with the UK. NSP intake was significantly lower in boys aged 4 to 10 years in Scotland compared with the UK (10.8g compared with 11.5g). Mean NSP intake was also significantly lower in girls aged 4 to 10 years and women aged 19 to 64 years and 65 years and over in Scotland compared with the UK (10.2g, 12.1g and 11.7g compared with 10.7g, 12.8g and 13.1g respectively). In both Scotland and the UK samples, mean NSP intakes were well 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 intakes 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).[10] In the Years 1 to 4 combined data, for both the UK sample and the Scotland sample, there is a slight over-representation of weekend days than weekdays and this should be taken into account when interpreting findings on alcohol intake (see section 5.1, Table 5A).

For adults, there were no statistically significant differences between Scotland and the UK sample for mean alcohol intake in men or women aged 19 years and over. Male consumers aged 19 to 64 years in Scotland had a higher mean intake of alcohol compared with the UK, but this was not statistically significant. The difference in mean alcohol intake was less marked in women and conversely tended to be lower in Scotland compared with the UK, but this was also not statistically significant.

(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 food sources only (excluding dietary supplements). Mean daily intakes of these vitamins and minerals are compared with the UK Reference Nutrient Intakes (RNIs)[11] and the proportions of participants with intakes below the Lower Reference Nutrient Intakes (LRNIs)[12] are provided. The RNIs and LRNIs for the vitamins and minerals presented are shown in Tables 5.14 and 5.32 (Chapter 5).

- There were no significant differences between Scotland and the UK for mean daily iron intakes for any age/sex group with the exception of women aged 65 years and over where mean intake in Scotland was significantly lower than in the UK (8.8mg compared with 9.4mg). All male age groups had mean iron intakes close to or above the RNI in both Scotland and the UK. Mean iron intake for girls aged 11 to 18 years and women aged 19 to 64 years fell below the RNI in both Scotland and the UK. For girls aged 11 to 18 years, 54% in Scotland and 46% in the UK had intakes below the LRNI. For women aged 19 to 64 years, 24% in Scotland and 23% in the UK had intakes below the LRNI.

- There were no significant differences between Scotland and the UK for mean daily calcium intakes for any age/sex group except for boys aged 4 to 10 years and adults aged 65 years and over. In Scotland, boys aged 4 to 10 years had a

higher mean intake compared with the UK (875mg compared with 823mg) as did total boys aged 4 to 18 years overall (898mg compared with 859mg). Men and women aged 65 years and over in Scotland had significantly lower intakes of calcium compared with the UK (828mg compared with 924mg for men and 718mg compared with 796mg for women). Mean calcium intake for girls aged 11 to 18 years was below the RNI in both Scotland and the UK. For girls aged 11 to 18 years, 18% in Scotland and 19% in the UK had intakes below the LRNI. For women aged 19 to 64 years 8% in both Scotland and in the UK had intakes below the LRNI.

- There were no significant differences between Scotland and the UK for mean vitamin C intakes for any age/sex group except for adults aged 19 to 64 years, where mean intake was significantly lower in Scotland (76.6mg) compared with the UK (82.9mg). All age/sex groups exceeded the RNI in both Scotland and the UK.

- Mean intakes of folate were slightly lower in all age/sex groups in Scotland compared with the UK. They were significantly lower in men aged 65 years and over (267µg compared with 295µg), women aged 19 to 64 years (213µg compared with 228µg) and women aged 65 years and over (211µg compared with 241µg) in Scotland compared with the UK. Girls aged 11 to 18 years in both Scotland and the UK had mean a intake of folate which fell below the RNI (88% and 93% respectively). For girls aged 11 to 18 years, 10% in Scotland and 8% in the UK had intakes below the LRNI.

- There were no significant differences between Scotland and the UK for mean vitamin D intakes for any age/sex group. Mean dietary intakes of vitamin D were similar in both males and females in Scotland and the UK. Men aged 65 years and over in Scotland had a slightly lower mean vitamin D intake compared with the UK, however, this did not reach statistical significance. In both Scotland and the UK, children aged 1.5 to 3 years and men and women aged 65 years and over had a mean intake of vitamin D below the RNI.[13]

(**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 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 on 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.[5] 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).

- There were no significant differences between Scotland and the UK for mean total fruit consumption for any age/sex group. There were small differences in mean consumption but there was no consistent pattern across the age/sex groups.

- Mean total vegetable consumption was significantly lower in Scotland than in the UK for the majority of age/sex groups; in children aged 1.5 to 3 years (65g compared with 72g), total boys aged 4 to 18 years (92g compared with 109g) and total girls aged 4 to 18 years (88g compared with 102g), men aged 19 to 64 years (158g compared with 182g), women aged 19 to 64 years (162g compared with 183g) and women aged 65 years and over (157g compared with 179g).

- With the exception of girls aged 11 to 18 years and men aged 65 years and over, all age/sex groups in Scotland, where the "5-A-Day" criteria can be applied (see Appendix A), had a lower mean consumption of portions of fruit and vegetables compared with the same age groups in the UK sample. The differences were significant in men aged 19 to 64 years (3.6 compared with 4.0 portions per day) and women aged 19 to 64 years (3.7 compared with 4.0 portions per day). The percentage of the population achieving "5-A-Day" was largely the same in Scotland and the UK sample; with the exception of adults aged 19 to 64 years where the percentage of the population achieving "5-A-Day" was significantly lower in Scotland (24%) compared with the UK (28%).

- There were no significant differences in mean total meat and red meat consumption in any age/sex group between Scotland and the UK.

- Mean oily fish consumption was similar for all age and sex groups in both Scotland and the UK. The largest difference was in adults aged 65 years and over where mean consumption was 9g per day in Scotland, significantly lower

than the mean consumption of 13g per day in the UK. No age/sex groups met the recommendation for oily fish consumption.

(Tables 10.6a–10.6c)

10.6 Indicator foods and drinks high in fat and sugar

These food and drinks high in fat and sugar,[7,8] namely 'biscuits', 'buns, cakes and pastries', 'confectionery' and 'soft drinks, non-diet'[6] have been targeted for population level reduction in Scotland. Results are provided for the total Scotland sample; including non-consumers (i.e. those who did not consume from a food group during the four-day diary recording period).

- Mean consumption of 'biscuits' was significantly lower in children aged 11 to 18 years in Scotland (13g) compared with the UK (17g). In adults aged 65 years and over, mean consumption was significantly higher in Scotland (18g) compared with the UK (13g).

- Overall there was no consistent difference in mean consumption of 'buns, cakes and pastries' between Scotland and the UK.

- Overall there was no consistent pattern of differences in mean consumption of 'confectionery' between Scotland and the UK. Mean 'confectionery' consumption in children aged 1.5 to 3 years was significantly higher in Scotland compared with the UK (12g compared with 9g). In Scotland, boys aged 4 to 10 years in Scotland also had a significantly higher mean consumption than the UK (23g compared with 17g).

- Mean consumption of 'soft drinks, non-diet'[6] tended to be higher in Scotland compared with the UK for children aged 4 to 18 years and adults aged 19 to 64 years but reached statistical significance only in boys aged 11 to 18 years. This age group had the highest consumption in Scotland and the biggest difference compared with the UK (362g compared with 309g). Mean consumption in women aged 65 years and over was significantly lower in Scotland (35g) compared with the UK (52g).

(Tables 10.7a-10.7c)

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

[2] It should be noted that for some dietary variables the UK values in this Scotland 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.

[3] Revised Dietary Goals for Scotland; http://www.scotland.gov.uk/Resource/0042/00421385.pdf (accessed 20/01/14).

[4] 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.

[5] For the NDNS RP, 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.

[6] See Appendix R of this report for a full definition (please note that this food group is referred to as 'Soft drinks, not low calorie' in Appendix R).

[7] http://www.scotland.gov.uk/Publications/2011/03/17104639/1 (accessed 27/01/14).

[8] http://www.scotland.gov.uk/Publications/2011/03/17104457/2 (accessed 27/01/14).
[9] Supporting Healthy Choices. A Framework for Voluntary Action. http://www.scotland.gov.uk/Publications/2014/06/8253

[10] Consumers also include those who consumed alcohol in recipes and other foods.

[11] 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.

[12] 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.

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