Scientific Advisory Committee on Nutrition

Paper for agreement: The nutritional health of the population

Agenda Item: 3

The attached paper summarises evidence from the National Diet and Nutrition Surveys carried out between 1992 and 2001 on the diet and nutritional status of the British population. This paper was first discussed by the Committee at the Horizon Scanning meeting in February 2005 and revised versions were discussed at the meetings in June and October 2005 and June 2006. This version incorporates comments made at those meetings.

A list of the changes requested at the June 2006 meeting and the actions taken is also included.

- The paper is presented to the Committee for agreement.

Amendments made following comments at the June 2006 meeting.

SACN comment	Action
Clarify distinction between DRVs for macro and micro nutrients.	Explanation added to para. 12
Consider calculating level of under-reporting for 1986/87 survey using PAL of 1.4.	Not done due to time constraints.
Change reporting of meat consumption from grams per week to grams per day (in line with COMA recommendation).	Meat consumption tables changed from g/week to g/day.
Give meat consumption data for men and women combined.	Not done. Would require a redesign of tables.
Give more prominence to alcohol data – significant proportion exceeding current guidelines. Link excess to obesity.	Comment added at para 70 and in the summary
Give more prominence to NSP data – low intakes – include in summary, conclusion and recommendations.	Comment added at para 69 and summary
Under-reporting acknowledged in para 9. Repeat this in para 33.	Para 33 amended to include underreporting with cross reference to para 9
Blood lipids section needs to be strengthened to be more positive about the fall in plasma cholesterol levels, especially in older men, and impact on reducing cardiovascular disease risk. Fall cannot be explained by use of statins.	Amended para 39 and summary
Emphasise reduced HDL chol usually linked with insulin resistance and obesity.	Amended para 40
Need to insert caveat – different assays used for analysis of lipids in 1986/87 and 2000/01, but are clearly genuine biological effects (eg comparison of older vs younger).	Amended para 39
Para 68 and Table 12 (RNI protein) do not tally. Protein needs to be in grams	Table 12 amended to include protein intake as % of RNI

SACN Position Paper

Nutritional Health of the Population

Summary

1) This paper brings together evidence relating to the nutritional health of the population in Great Britain. The current situation is described using data from the National Diet and Nutrition Surveys (NDNS), while changes in the adult population are highlighted by comparison of results from the NDNS in 2000/01 with the comparable survey in 1986/87.

2) Although there is some evidence of positive dietary changes in the population, especially lower intakes of fat and saturated fat in the 2000/01 NDNS compared with the 1986/87 adults survey, the findings from surveys of these and other age groups highlight a number of areas for concern. Consumption of fruit and vegetables is below the recommendation in all age groups, and is particularly low for young adults and people in lower socio-economic groups. There is evidence of low intakes and status for a number of vitamins and minerals especially for older children, young adults and older people living in institutions. The proportion of energy intake derived from non-milk extrinsic sugar (NMES) exceeds the recommendation in most age groups, particularly for children and young adults. There is also evidence of marked differences in diet and nutritional status associated with socio-economic status. These findings indicate a need to improve the balance of the diet for the population as a whole with the focus on children and young adults.

Background

3) This paper presents an overview of the nutritional health of the population based on data from the four surveys in the National Diet and Nutrition Survey programme (NDNS) carried out between 1992 and 2001. Results from the most recent NDNS of adults aged 19-64 years[5,6,7,8,9] (2000/01) are also compared with the 1986/87 Dietary and Nutritional Survey of British Adults aged 16-64 years[1].

4) The paper highlights specific diet and nutritional issues in different age groups, as well as discussing regional and socio-economic differences. Differences highlighted in the commentary are statistically significant unless otherwise indicated.

5) The NDNS is a series of cross-sectional surveys of different population age groups. It aims to provide a comprehensive picture of the dietary habits and nutritional status of the population of Great Britain. The programme is split into four separate surveys. Each survey has examined a nationally representative sample drawn from four different population age groups: children aged 1½-4½ years[2] (fieldwork 1992/93), young people aged 4-18 years[4] (1997), adults aged 19-64 years[5,6,7,8,9] (2000/01) and people aged 65 years and over[3] (1994/95). Each survey collected detailed quantitative information on food consumption and nutrient intake, physical measurements, nutritional status indices and socio-economic, demographic and lifestyle characteristics.

6) The NDNS programme covers the British population aged 1½ years upwards living in private households. The survey of people aged 65 years and over also included a sample of people living in residential and nursing homes. The NDNS programme does not cover infants and children aged under 18 months, pregnant and lactating women or people living in institutions such as prisons, schools, hospitals and care homes.

7) The surveys in the NDNS programme are designed to be representative of the British population within the specified age group. The sample size for each survey permits a more detailed analysis by age and sex but does not allow for separate analysis of specific population sub-groups such as ethnic minority groups, vegetarians etc. In interpreting the data it should be borne in mind that the surveys have been carried out over a 15 year period and so secular trends may confound apparent differences between survey age groups.

8) The methodologies used for collecting food consumption data are comparable between surveys. The analytical methods used for nutritional status measures are also generally comparable between surveys, with the exception of the 1986/87 adults survey which used different analytical methods and/or laboratories for many measures.

9) Mis-reporting of food consumption in dietary surveys, generally under-reporting, is known to be a problem in NDNS as in dietary surveys worldwide.[6,10] Under-reporting can cause biased low estimates of intake as respondents under-report their actual intake or modify their diet during the recording period. The level of under-reporting needs to be borne in mind when interpreting findings from dietary surveys, for example in comparing intakes with recommendations. Analysis of data from the NDNS adults 2000/01 indicated that energy intake was under-reported to a level of 25% of energy needs on average. It is not possible to ascertain whether under-reporting was higher in this survey than in the 1986/87 survey because there was no assessment of physical activity or energy expenditure in the earlier survey. Doubly labelled water studies suggest similar levels of under-reporting for other age groups except for pre-school children where levels were lower. There is evidence that under-reporting is selective – fatty, sugary and snack foods and alcohol are more likely to be under-reported than are other foods such as fruit and vegetables. However the level of under-reporting for specific macro and micronutrients is not known.

10) Following a review of the Food Standards Agency's dietary survey programme in 2002/03 the Agency's Board has agreed to move to a rolling programme format for future NDNS, whereby the survey runs continuously and fieldwork is carried out every year. This new approach will strengthen the ability to track trends over time and give more flexibility to respond to policy needs.

Diet and nutritional status in the population

11) This section sets out findings under the headings of dietary habits, energy and macronutrient intakes, micronutrient intakes and nutritional status, and oral health, focusing on the following age groups: adults, older adults (including free-living and institution groups), children and young people.

12) Throughout the paper, nutrient intakes are compared with COMA Dietary Reference Values[11] and other COMA recommendations[12,13]. Dietary Reference Values (DRV) for total fat, saturated and trans fatty acids and non-milk extrinsic sugars are the recommended *maximum* contribution these nutrients should make to the diet, expressed as percentage of energy intake. For total carbohydrate, cis monounsaturated fatty acids and non-starch polysaccharide (NSP), the DRVs are population *averages*, i.e. the average contribution, as a percentage of energy, that total carbohydrate and cis monounsaturated fatty acids should make and the average intake of NSP in grams per day. For energy the DRV is the Estimated Average Requirement (EAR), that is the intake that meets the energy requirement of 50% of the population group. Finally, DRVs

for protein, vitamins and minerals are expressed as Lower Reference Nutrient Intakes (LRNI) (not protein) and Reference Nutrient Intakes (RNI), the intakes at which the requirements of 2.5% and 97.5% of the population group are met. Mean intakes *at or above* the RNI for these nutrients are desirable. It is important to note, therefore, that to 'meet the DRV' can mean that intake of that nutrient is at or below the DRV (e.g. trans fatty acids) or that intake is at or above the DRV (e.g. NSP). Nutritional status indices are compared with published threshold values.

Dietary habits

13) This section considers findings for consumption of fruit and vegetables, oily fish, meat and meat products, soft drinks and dietary supplements and compares dietary habits in adults between the 1986/87 and 2000/01 surveys. Consumption of fruit and vegetables and oily fish are compared with Government recommendations.

Adults

Fruit and vegetables[i] *(Tables 1 & 2; Figure 1)*

14) In the most recent NDNS (2000/01) the average consumption of fruit and vegetables for adults aged 19-64 years was 2.7 portions per day for men and 2.9 portions for women, calculated based on the definition used in the five-a-day programme[ii] (Table 1). Seventeen percent of adults ate less than one portion of fruit and vegetables a day, while 13% of men and 15% of women met the five-a-day target. Mean consumption increased with age for both men and women but was below the five-a-day recommendation in all age groups. Mean consumption was lowest in the 19-24 group at 1.3 portions per day for men and 1.8 portions for women.

15) Comparing the consumption of fruit and vegetables by adults in the 1986/87 and 2000/01 surveys[iii] consumption was higher in 2000/01 by 140 grams/week on average for men and 280g/week for women. The greatest difference in consumption was in the 50-64 age group which was over 450g/week higher for both men and women in 2000/01 compared with 1986/87. In young adults (19-24 years) there was no evidence of an increase in consumption and in men aged 19-34 years the data suggest lower consumption in 2000/01 although the difference did not reach statistical significance (Table 2).

Oily fish (Table 3; Figure 2)

16) Mean consumption of oily fish (excluding canned tuna)[iv] in the 2000/01 adults survey was just over a third of a portion[v] per week, below the recommendation of one portion per week. Mean consumption increased with age from around 0.1 portions per week in the 19-24 age group to 0.6 portions per week in the 50-64 year age group. Consumption

[i] Includes fruit juice

[ii] The definition of fruit and vegetable consumption used in the NDNS used for comparison with the five-a-day recommendation is: daily consumption of fruit and vegetables (excluding potatoes), including those in selected composite dishes (fruit pies and vegetable dishes), and including all fruit juice consumed as one portion only, and similarly all baked beans and other pulses consumed as one portion only.

[iii] Comparison of fruit and vegetable consumption in the 1986/87 and 2000/01 surveys is not based on the 5-a-day definition as this analysis is not available for the 1986/87 survey.

[iv] canned tuna is not included in the definition of an oily fish, as processing of tuna during the canning process reduces the fat content of the fish to a low level

[v] A portion of oily fish is defined as around 140grams

in the 50-64 group was higher in 2000/01 compared to 1986/87 for both men and women but this difference was not seen in the 19-24 group (Table 3).

Meat, meat products and dishes (Tables 4a & b)

17) Mean consumption of meat, meat products and dishes as a group was higher for men in 2000/01 (200g/day) compared with 1986/87 (183g/day). There was no significant difference for women. Mean consumption of liver (including products and dishes), meat pies and pastries and "other" meat and meat products was lower in 2000/01 than in 1986/87, for both men and women, whereas consumption of coated chicken & turkey, chicken and turkey dishes and, for men only, burgers and kebabs was higher in 2000/01 than in 1986/87. Chicken and turkey was the most commonly consumed type of meat in 2000/01 for both men and women whereas in 1986/87 the most commonly consumed type was beef and veal.

Figure 1. Mean number of portions of fruit and vegetables consumed per day (based on five-a-day definition) by adults in 2000/01

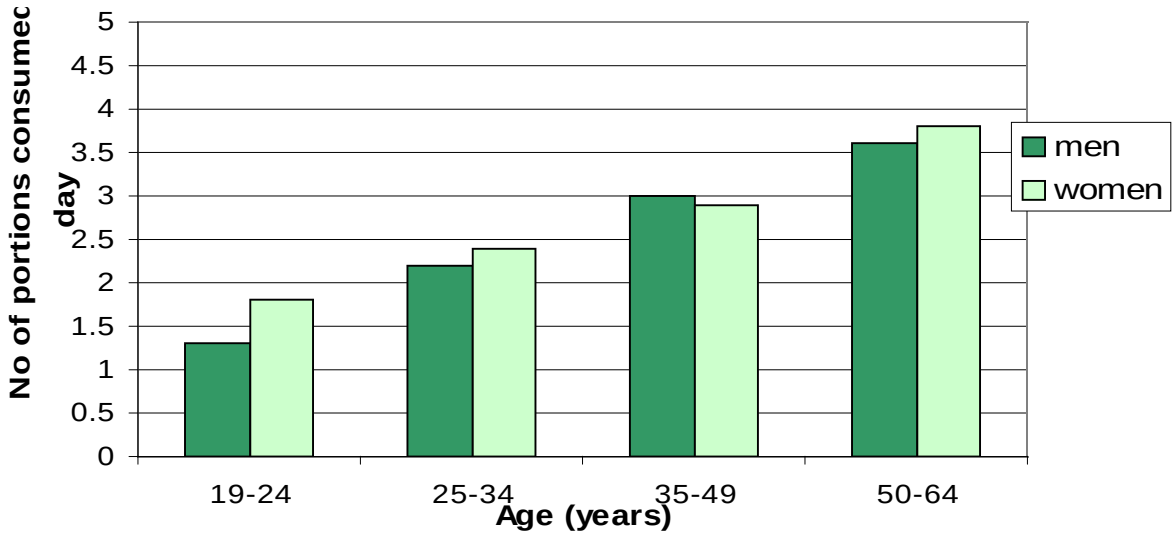
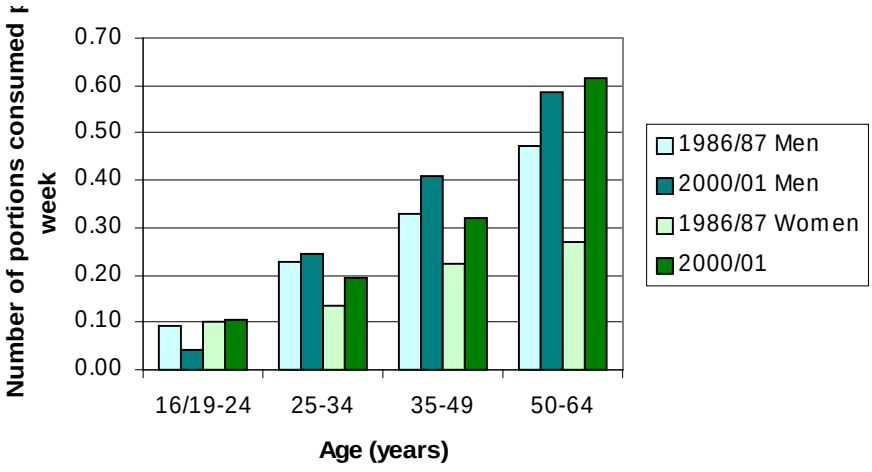


Figure 2: Comparison of average number of portions of oily fish (excluding canned tuna) consumed per week between 1986/87 and 2000/01

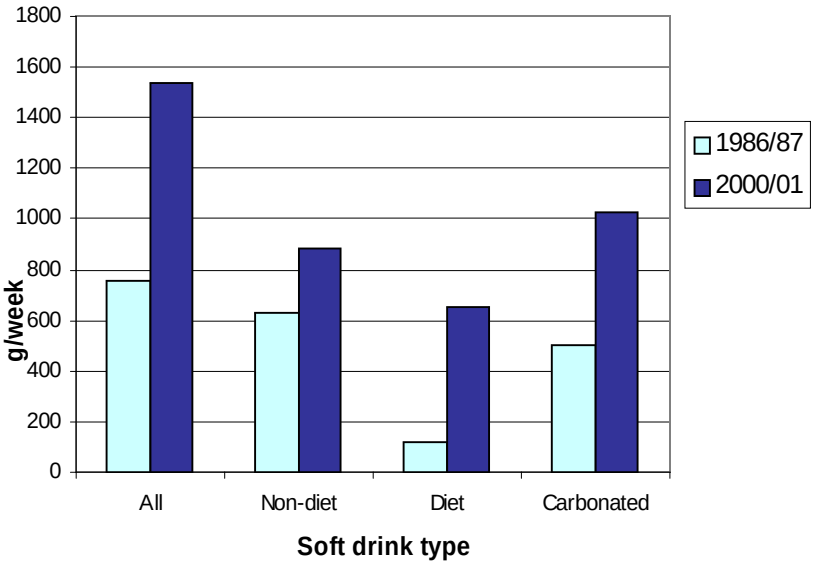


18) COMA recommended in its 1998 report on nutritional aspects of cancer that average consumption of red and processed meat should not increase from the then current average of 90g/day[14]. The data show that consumption of red and processed meat and meat-based dishes (that is excluding chicken and turkey and dishes) was lower in 2000/01 than in 1986/87 for both men (138g/day in 2000/01) and women (79g/day in 2000/01)[vi] Although the data from the NDNS are not directly comparable with the recommendation the lower consumption of red and processed meat and meat based dishes in the most recent survey suggests that the trend in consumption is in the direction of the recommendation.

Soft drinks (Tables 5a & b; Figure 3)

19) Consumption of soft drinks in adults was substantially higher in 2000/01 than in 1986/87. Mean consumption levels in 2000/01 were equivalent to 4-5 cans per week, compared to less than 3 cans per week in 1986/87. The majority of soft drinks consumed were carbonated. Women consumed similar amounts of diet and non-diet varieties on average while men consumed more of the non-diet type. In 2000/01 young men and women (19-24 years) consumed over three times the quantity of soft drinks as did the oldest men and women (50-64 years).

Figure 3: Mean consumption of soft drinks by adults in 1986/87 and 2000/01



Dietary supplements

20) Forty percent of women and 29% of men overall in the 2000/01 adults survey reported taking dietary supplements in the survey week. This compared with 17% of women and 9% of men in 1986/87. Use of supplements increased with age to 55% of women in the 50-64 age group. Cod liver oil and other fish oil based supplements and multi-vitamins and multi-minerals were the most commonly used types of supplements in this age group.

[vi] Consumption figures include non-meat components of meat-based dishes and so are not directly comparable with the COMA recommendation

Older adults aged 65 and over

Fruit and vegetables group (Table 6)

21) Mean fruit and vegetable consumption[vii] in the free-living group aged 65 and over was slightly lower than in the adult population at 244 and 230g/day for men and women respectively, the difference being due to lower consumption of vegetables and fruit juice. In the institution group mean consumption was substantially lower than in the free-living group at 171 and 163g/day in total for men and women respectively.

Oily fish (Table 7)

22) Mean consumption of oily fish (excluding canned tuna) in the free-living group was substantially higher than that in the adult population for men at 85g/week, but similar for women at 47g/week. Older adults living in institutions had a lower average oily fish consumption than their free-living counterparts at around 28g/week for men and women. Data on this age group was collected in the mid-1990s and oily fish like salmon has become cheaper and more available since then.

Meat, meat products and dishes (Table 8)

23) Mean consumption of meat, meat products and dishes in the free-living group aged 65 and over was lower than in the 50-64 age group, at 128g/day and 98g/day for men and women respectively. Mean consumption in the institution group was lower than in the free-living group. Beef, veal and dishes was the most commonly consumed type of meat in both the free-living and institution groups.

Soft drinks (Table 10)

24) Consumption of soft drinks by older adults was lower than in the 19-64 age group. Mean consumption was 347 and 322g/week for men and women respectively in the free-living group (equivalent to about 1 can per week). Non-diet concentrated squashes and carbonates were the most commonly consumed types. Consumption in the institution group was over twice that in the free-living group at about 850g/week, largely due to high consumption of non-diet fruit squashes in this group.

Dietary supplements

25) In older people aged 65 and over, 28% of men and 34% of women in the free-living group reported taking supplements, most commonly cod-liver oil based. In the institution group the proportion that reported taking supplements was much lower – 5% of men and 9% of women. Use of vitamin D supplements, for example, was reported by 3% of the institution group and 16% of the free-living group[15].

Children and young people aged 1½-18 years

Fruit and vegetables (Table 6)

26) Mean consumption of fruit and vegetables[viii] in the 4-18 year group was around 170-190 grams/day in the 4-6, 7-10 and 11-14 age groups and around 200g/day in the 15-18 age group. Twenty percent of the 4-18 age group did not consume any fruit (excluding fruit

[vii] consumption estimates not based on the 5-a-day definition. Includes fruit juice
[viii] Consumption estimates not based on 5-a-day definition. Includes fruit juice

juice) during the survey week and 4% consumed no vegetables. Mean consumption in the 1½-4½ year group was 126 grams/day.

Oily fish (Table 7)

27) Consumption of oily fish (excluding canned tuna) was less than 0.1 portions (5-10 grams) per week in all age groups.

Meat, meat products and dishes (Table 9)

28) Mean consumption of meat, meat products and dishes was 52g/day in the 1½-4½ year age group. Beef, veal and dishes was the most commonly consumed type providing about a quarter of consumption, followed by sausages. In the 4-18 year age group mean consumption of meat, meat products and dishes in boys aged 15-18 was more than double that in the 4-6 year group. There was a less marked difference with age in girls. Chicken and turkey dishes was the main type of meat consumed in all age/sex groups but the contribution of beef, veal and dishes, bacon and ham, burgers and kebabs was substantially higher in the 15-18 year old boys compared to other age groups.

Soft drinks (Table 10)

29) Consumption of soft drinks in the 1½-4½ year age group was 2.8 litres/week, equivalent to about 8 cans or 14 cartons. Concentrated squashes were the main type of soft drink consumed by this age group. In older children mean consumption was over 3 litres per week in the 7-10 year age group and over 3.5 litres/week for 11-18 year old boys. Consumption in girls in the same age group was slightly lower at around 2.6 litres/week. Non-diet carbonated drinks were the main type of soft drink consumed in the 11-18 age group.

30) There is no earlier comparable national survey of this age group from which to assess trends in soft drink consumption. However two comparable studies of 11-12 year olds in Northumberland carried out in 1980 and 2000[16] show that carbonated soft drink consumption in this group was 2½ times higher in 2000 (191g/day; 1337g/week) than in 1980 (78g/day; 546g/week)[ix]. These studies also showed an inverse relationship between consumption of soft drinks and of milk. The consumption data from 2000 for carbonated drinks are similar to the NDNS data collected in 1997 for the 11-14 year age group (1865g/week for boys and 1507g/week for girls).

Dietary supplements

31) In children aged 1½-4½ years, surveyed in 1992, a fifth of this age group reported taking supplements, mainly vitamins A, C and D and multivitamins. In the later survey of the 4-18 year age group in 1997 a fifth of this group overall reported using supplements. Reported usage was 32% and 23% of boys and girls in the 4-6 age group and 13% and 22% of boys and girls in the 15-18 age group.

<u>Overview of dietary habits</u>

32) Mean consumption of fruit and vegetables (including fruit juice) was below the five-a-day target in all age groups. There was evidence of higher consumption in the 50-64 age

[ix] Data from this study for total soft drink consumption are not comparable with NDNS data. Total soft drink consumption in this study was 109g/day (763g/week) in 1980 and 291g/day (2047 g/week) in 2000/01.

group compared with 1986/87 but there was no evidence of this for the youngest group (19-24 years); the data suggested that consumption by young men was slightly lower in the more recent survey. Mean consumption of oily fish was below the recommended level of one portion per week in all age groups. Again there was some evidence of higher consumption in adults (particularly women) aged 50-64 years in 2000/01 compared with 1986/87 but not in the 19-24 year group. Consumption of soft drinks in the 19-64 age group in the more recent survey was substantially higher than in 1986/87, mainly due to higher consumption of carbonated drinks. Mean consumption of meat, meat products and dishes was slightly higher for men but not women in 2000/01 compared with 1986/87 though when chicken and turkey were excluded consumption was slightly lower for both men and women. Consumption of chicken and turkey dishes in 2000/01 was double that in 1986/87 for men and women while consumption of liver, meat pies and 'other' meat and products was lower in the more recent survey. Over a third of adults reported taking dietary supplements in the most recent survey.

Table 1: Consumption of fruit and vegetables (using five-a-day definition*) by adults aged 19-64 years (portions per day)**

Average daily number of portions of fruit and vegetables consumed	Men aged (years):				All men	Women aged (years):				All women	All
	19-24	25-34	35-49	50-64		19-24	25-34	35-49	50-64		
	Cumulative percentages										
	cum %	cum %	cum %	cum %	cum %	cum %	cum %	cum %	cum %	cum %	cum %
None	6	1	0	1	1	2	1	1	0	1	1
Less than 1 portion	38	27	14	7	18	36	19	16	7	16	17
Less than 2 portions	86	54	36	29	45	64	46	41	20	39	42
Less than 3 portions	95	76	59	45	64	83	71	61	44	61	62
Less than 4 portions	95	86	75	60	76	96	82	73	60	74	75
Less than 5 portions	100	93	86	76	87	96	91	83	78	85	86
Number of subjects (unweighted)	*61*	*160*	*303*	*242*	*766*	*78*	*211*	*379*	*290*	*958*	*1724*
Mean number of portions consumed (average value)	1.3	2.2	3.0	3.6	2.7	1.8	2.4	2.9	3.8	2.9	2.8

* The definition of fruit and vegetable consumption used for the five-a-day programme is: daily consumption of fruit and vegetables, including those in selected composite dishes (fruit pies and vegetable dishes), and including all fruit juice consumed as one portion only, and similarly all baked beans and other pulses consumed as one portion only

** 1 portion = 80 grams

Table 2: Consumption of fruit and vegetables* for adults in 1986/87 and 2000/01 (grams per week)

Mean consumption g/week	1986/87 Adults Survey Men aged:					2000/01 NDNS Men aged:				
	16-24	25-34	35-49	50-64	All	19-24	25-34	35-49	50-64	All
Vegetables (excluding potatoes)	832	1000	1139	1137	1046	665	854	1006	1135	961
Fruit	253	430	504	596	460	190	428	694	855	607
Fruit Juice	313	322	233	181	257	264	258	393	385	339
Total (Vegetables, Fruit, Fruit juice)	1398	1752	1876	1914	1763	1119	1540	2093	2375	1907
Number of subjects (unweighted)	*214*	*254*	*346*	*273*	*1087*	*61*	*160*	*303*	*242*	*766*

Mean consumption g/week	1986/87 Adults Survey Women aged:					2000/01 NDNS Women aged:				
	16-24	25-34	35-49	50-64	All	19-24	25-34	35-49	50-64	All
Vegetables (excluding potatoes)	700	828	905	965	868	626	911	970	1004	926
Fruit	371	419	580	709	540	379	521	687	1060	720
Fruit Juice	311	312	259	259	280	353	316	301	358	327
Total (Vegetables, Fruit, Fruit juice)	1382	1559	1744	1933	1684	1358	1748	1958	2422	1973
Number of subjects (unweighted)	*189*	*253*	*385*	*283*	*1110*	*78*	*211*	*379*	*290*	*958*

* Not calculated using 5-a-day definition. May include more than one portion of fruit juice and more than one portion of beans/pulses.

Table 3: Consumption of oily fish* per week in adults in 1986/87 and 2000/01

Gender and age	1986/87			2000/01		
	Mean (g/week)*	Number of portions**	*Number of subjects (unweighted)*	Mean (g/week)*	Number of portions**	*Number of subjects (unweighted)*
Male aged (years)						
19-24	12	0.1	*134*	5	< 0.1	*61*
25-34	34	0.2	*254*	32	0.2	*160*
35-49	49	0.3	*346*	56	0.4	*303*
50-64	66	0.5	*273*	80	0.6	*242*
All (19-64 years)	45	0.3	*1007*	51	0.4	*766*
Female aged (years)						
19-24	20	0.1	*119*	14	0.1	*78*
25-34	19	0.1	*253*	28	0.2	*211*
35-49	33	0.2	*385*	46	0.3	*379*
50-64	38	0.3	*283*	88	0.6	*290*
All (19-64 years)	29	0.2	*1040*	50	0.4	*958*

* Excludes canned tuna. Includes recipe dishes
** One portion = 140 grams

.

Table 4a: Consumption of meat, meat products and dishes† by men in1986/7 and 2000/01 (grams per day)

	1986/87 Adults Survey					2000/01 NDNS				
Men aged (years)	16-24	25-34	35-49	50-64	All	19-24	25-34	35-49	50-64	All
g/week	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)
Bacon & ham	19	17	19	23	20	18	18	19	22	20
Beef, veal & dishes	37	52	46	39	44	45	43	43	40	42
Lamb & dishes	10	10	9	14	10	6	10	8	9	9
Pork & dishes	10	14	11	13	12	6	10	12	14	11
Coated chicken & turkey	2	3	2	1	2	12	9	8	3	7
Chicken & turkey dishes	28	29	26	22	26	49	58	60	48	54
Liver & liver products & dishes	2	4	5	5	4	0	2	3	3	2
Burgers & kebabs	18	12	5	3	9	27	18	10	2	12
Sausages	17	14	13	12	14	17	14	14	11	13
Meat pies & pastries	38	25	23	19	25	19	20	20	21	20
Other meat & meat products*	18	17	16	17	17	5	7	8	11	8
Total meat, meat products & dishes**	198	195	176	168	183	205	209	205	184	200
Number of subjects	*214*	*254*	*346*	*273*	*1087*	*61*	*160*	*303*	*242*	*766*

† Consumption data includes non-meat components of meat-based dishes

*Includes game, duck, goose, all offal (except liver), black pudding, corned beef, salami etc.

**Sum of individual food groups may not equal total consumption of meat, meat products & dishes due to rounding.

Table 4b: Consumption of meat, meat products and dishes† by women in1986/7 and 2000/01 (grams per day)

	1986/87 Adults Survey					2000/01 NDNS				
Females aged (years)	16-24	25-34	35-49	50-64	All	19-24	25-34	35-49	50-64	All
g/week	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)	Mean (g)
Bacon & ham	10	11	12	14	12	9	10	11	12	11
Beef, veal & dishes	29	32	31	26	30	33	25	31	30	29
Lamb & dishes	7	5	7	9	7	4	4	6	7	6
Pork & dishes	8	8	7	8	7	5	6	8	7	7
Coated chicken & turkey	3	2	2	1	2	11	6	7	3	6
Chicken & turkey dishes	17	18	22	18	19	38	39	43	36	39
Liver & liver products & dishes	3	3	5	5	4	0	1	1	1	1
Burgers & kebabs	10	7	5	2	5	15	7	5	2	6
Sausages	8	8	7	7	8	8	7	6	5	6
Meat pies & pastries	15	13	13	12	13	9	8	10	9	9
Other meat & meat products*	11	10	11	9	10	3	2	4	6	4
Total meat, meat products & dishes**	120	117	122	110	117	135	115	131	119	124
Number of subjects	*189*	*253*	*385*	*283*	*1110*	*78*	*211*	*379*	*290*	*958*

† Consumption data includes non-meat components of meat-based dishes

*Includes game, duck, goose, all offal (except liver), black pudding, corned beef, salami etc.

**Sum of individual food groups may not equal total consumption of meat, meat products & dishes due to rounding.

Table 5a: Consumption of soft drinks by men in 1986/87 and 2000/01 (grams per week)

	1986/87 adults survey								2000/01 NDNS							
Males aged (yrs)	19-24		25-34		35-49		50-64		19-24		25-34		35-49		50-64	
	Mean†	% consumers††	Mean	% consumers	Mean	% consumers	Mean	% consumers	Mean	% consumers	Mean	% consumers	Mean	% consumers	Mean	% consumers
Non diet soft drinks	1,380	*75*	766	*71*	*513*	*57*	308	*49*	2,662	*94*	1336	*79*	766	*58*	478	*44*
Of which:																
Non diet RTD	146	*23*	72	*17*	*58*	*12*	67	*11*	163	*24*	65	*14*	50	*11*	50	*9*
Non diet concentrates*	404	*24*	162	*20*	131	*16*	72	*15*	436	*25*	324	*30*	275	*22*	184	*15*
Non diet carbonates	830	*66*	532	*57*	324	*45*	169	*36*	2,063	*92*	946	*64*	441	*44*	243	*33*
Diet soft drinks	73	*9*	150	*14*	83	*12*	70	*8*	565	*34*	837	*40*	612	*40*	388	*26*
Of which																
Low calorie RTD	7	*1*	1	*1*	2	*1*	0	*0*	-	-	2	*0*	4	*1*	10	*1*
Low calorie concentrates*	13	*2*	30	*2*	12	*2*	25	*2*	240	*12*	278	*15*	232	*15*	137	*9*
Low calorie carbonates	53	*7*	119	*11*	68	*10*	45	*7*	325	*26*	557	*30*	376	*30*	242	*22*
Total soft drinks**	1453	*77*	915	*73*	595	*60*	379	*54*	3227	*96*	2182	*89*	1377	*72*	866	*58*
Number of subjects (unweighted)	*134*		*254*		*346*		*273*		*61*		*160*		*303*		*242*	

* Includes water used as a diluent

** Sum of individual soft drink groups may not equal total consumption of soft drinks due to rounding.

††% consumers = percentage of the age group who reported consuming in the seven-day dietary assessment period

†Mean values include non-consumers

RTD = ready to drink

Table 5b: Consumption of soft drinks by women in 1986/87 and 2000/01 (grams per week)

	1986 /87 Adults Survey								2000/01 NDNS							
Females aged (years)	19-24		25-34		35-49		50-64		19-24		25-34		35-49		50-64	
	Mean† (g)	% consumers††	Mean (g)	% consumers	Mean (g)	% consumers	Mean (g)	% consumers	Mean (g)	% consumers	Mean (g)	% consumers	Mean (g)	% consumers	Mean (g)	% consumers
Non diet soft drinks	1033	84	652	69	*439*	59	241	48	1705	78	771	63	560	54	416	44
Of which																
Non diet RTD	115	24	85	17	*55*	14	45	10	102	20	92	15	95	13	72	11
Non diet concentrates*	202	35	140	27	139	24	76	16	409	38	258	23	144	20	114	14
Non diet carbonates	716	72	427	58	245	46	120	36	1194	64	421	47	321	38	230	32
Diet soft drinks	168	24	194	20	159	20	75	14	1002	53	1185	58	555	38	379	32
Of which																
Low calorie RTD	6	3	3	1	3	1	0	0	8	4	10	2	11	3	4	2
Low calorie concentrates*	1	1	19	3	6	1	45	5	195	27	284	19	111	9	95	8
Low calorie carbonates	161	21	171	17	150	19	30	11	800	35	892	50	433	34	281	26
Total soft drinks**	1201	89	846	75	598	66	317	56	2728	97	1960	86	1121	71	797	62
Number of subjects (unweighted)	*119*		*253*		*385*		*283*		*78*		*211*		*379*		*290*	

* Includes water used as a diluent

** Sum of individual soft drink groups may not equal total consumption of soft drinks due to rounding.

††% consumers = percentage of the age group who reported consuming in the seven-day dietary assessment period

†Mean values include non-consumers

RTD = ready to drink

Table 6: Mean vegetable, fruit and fruit juice consumption (grams per day)

Population group	Vegetables	Fruit	Fruit Juice	Total fruit, vegetables and fruit juice*	*Number of subjects (unweighted)*
	g/day	g/day	g/day	g/day	
Males & Females 1.5-4.5 years	39	50	37	126	*1675*
Males aged (years):					
4-6	60	63	44	167	*184*
7-10	58	62	54	174	*256*
11-14	73	42	55	170	*237*
15-18	94	44	62	200	*179*
19-64	137	87	48	273	*766*
65+ *Free-living*	123	97	24	244	*632*
65+ *Living in an institution*	102	60	9	171	*204*
Females aged (years):					
4-6	58	65	49	172	*171*
7-10	69	68	53	190	*226*
11-14	70	48	53	171	*238*
15-18	101	54	61	216	*210*
19-64	132	103	47	282	*958*
65+ *Free-living*	109	96	25	230	*643*
65+ *Living in an institution*	83	61	19	163	*208*

* Not calculated using 5-a-day definition. May include more than one portion of fruit juice and more than one portion of beans/pulses

Table 7: Average consumption of oily fish* per week

Gender and age	Mean (g)*	Number of portions**	*Number of subjects (unweighted)*
Males and females aged 1.5-4.5 years	5	<0.1	*1675*
Males aged (years)			
4-6	6	<0.1	*184*
7-10	5	<0.1	*256*
11-14	10	<0.1	*237*
15-18	10	<0.1	*179*
19-64	51	0.4	*766*
65+ *Free-living*	85	0.6	*632*
65+ *Living in an institution*	29	0.2	*204*
Females aged (years)			
4-6	7	<0.1	*171*
7-10	8	<0.1	*226*
11-14	5	<0.1	*238*
15-18	7	<0.1	*208*
19-64	50	0.4	*958*
65+ *Free-living*	47	0.3	*643*
65+ *Living in an institution*	28	0.2	*208*

*Excludes canned tuna. Includes recipe dishes
**One portion is about 140g

Table 8: Consumption of meat, meat products and dishes† by adults aged 65 years and over (grams per day)

	65+ Free-living			65+ Living in an Institution		
Type of Meat in g/week	Males Mean (g)	Females Mean (g)	All Mean (g)	Males Mean (g)	Females Mean (g)	All Mean (g)
Bacon & ham	17	12	14	12	9	10
Beef, veal & dishes	31	26	28	29	23	24
Lamb & dishes	9	6	7	8	7	7
Pork & dishes	9	7	8	6	4	4
Coated chicken & turkey	1	1	1	1	1	1
Chicken & turkey dishes	20	18	19	11	9	10
Liver & liver products & dishes	3	2	3	1	1	1
Burgers & kebabs	2	2	2	1	1	1
Sausages	8	6	7	8	5	5
Meat pies & pastries	20	12	16	16	12	13
Other meat products*	9	5	6	10	8	8
Total meat, meat products & dishes	128	98	110	104	80	85
Number of subjects (unweighted)	*632*	*643*	*1275*	*204*	*208*	*412*

† Consumption data includes non-meat components of meat-based dishes

*Includes game, duck, goose, all offal (except liver), black pudding, corned beef, salami etc

Table 9: Consumption of meat, meat products and dishes[†] by children and young people aged 4 to 18 years (grams per day)

	Males & females aged 1.5 to 4.5 years	Males aged 4 to 18 years					Females aged 4 to 18 years				
Type of Meat in g/week	1.5-4.5 Mean (g)	4-6 Mean (g)	7-10 Mean (g)	11-14 Mean (g)	15-18 Mean (g)	All Mean (g)	4-6 Mean (g)	7-10 Mean (g)	11-14 Mean (g)	15-18 Mean (g)	All Mean (g)
Bacon & ham	3	6	7	11	15	10	6	8	7	7	7
Beef, veal & dishes	12	12	16	17	33	20	10	18	20	21	18
Lamb & dishes	2	5	8	10	11	9	4	7	6	5	6
Pork & dishes	2	4	5	7	8	6	3	5	5	7	5
Coated chicken & turkey	3	9	10	9	13	10	9	10	11	13	11
Chicken & turkey dishes	7	14	17	28	39	25	16	19	23	27	21
Liver & liver products & dishes	0	0	0	0	1	0	0	0	0	0	0
Burgers & kebabs	3	5	6	11	20	11	5	6	9	10	7
Sausages	9	14	14	12	17	14	9	11	10	7	9
Meat pies & pastries	6	9	10	15	18	13	7	10	11	10	10
Other meat & meat products*	4	4	2	5	5	4	2	4	3	3	3
Total meat, meat products & dishes	52	81	96	126	180	122	71	97	105	110	97
Number of subjects (unweighted)	*1675*	*184*	*256*	*237*	*179*	*856*	*171*	*226*	*238*	*210*	*845*

[†] Consumption data includes non-meat components of meat-based dishes

*Includes game, duck, goose, all offal (except liver), black pudding, corned beef, salami etc.

Table 10: Mean consumption of soft drinks (grams per week)

Consumption (grams per week)	Non-diet				Diet				Diet and non-diet	
	Ready to drink	Conc-entrated*	Carb-onated	**Total non diet drinks**	Ready to drink	Conc-entrated*	Carb-onated	**Total diet drinks**	**Total soft drinks**	*No of subjects (unweighted)*
Males and females										
1½-4½ years	213	1291	419	1924	22	698	111	831	2755	*1675*
Males aged (years):										
4-6	227	703	491	1421	80	1105	341	1526	2946	*184*
7-10	218	859	807	1884	26	924	447	1396	3280	*256*
11-14	162	660	1266	2088	37	776	599	1412	3500	*237*
15-18	83	758	1889	2731	23	493	419	935	3667	*179*
19-64	69	282	725	1075	5	217	376	598	1673	*766*
65+ (free-living)	18	127	130	275	-	33	39	72	347	*632*
65+ (living in an institution)	68	579	58	705	11	122	11	144	848	*204*
Females aged (years)										
4-6	215	640	563	1418	62	953	332	1347	2764	*171*
7-10	211	758	671	1640	53	810	523	1386	3026	*226*
11-14	167	449	1036	1651	10	641	471	1122	2773	*238*
15-18	115	489	1129	1733	22	365	458	844	2577	*208*
19-64	88	198	420	707	8	157	540	705	1412	*958*
65+ (free-living)	17	126	111	254	2	32	34	68	322	*643*
65+ (living in an institution)	37	565	95	696	8	155	1	163	859	*208*

* Includes water used as a diluent

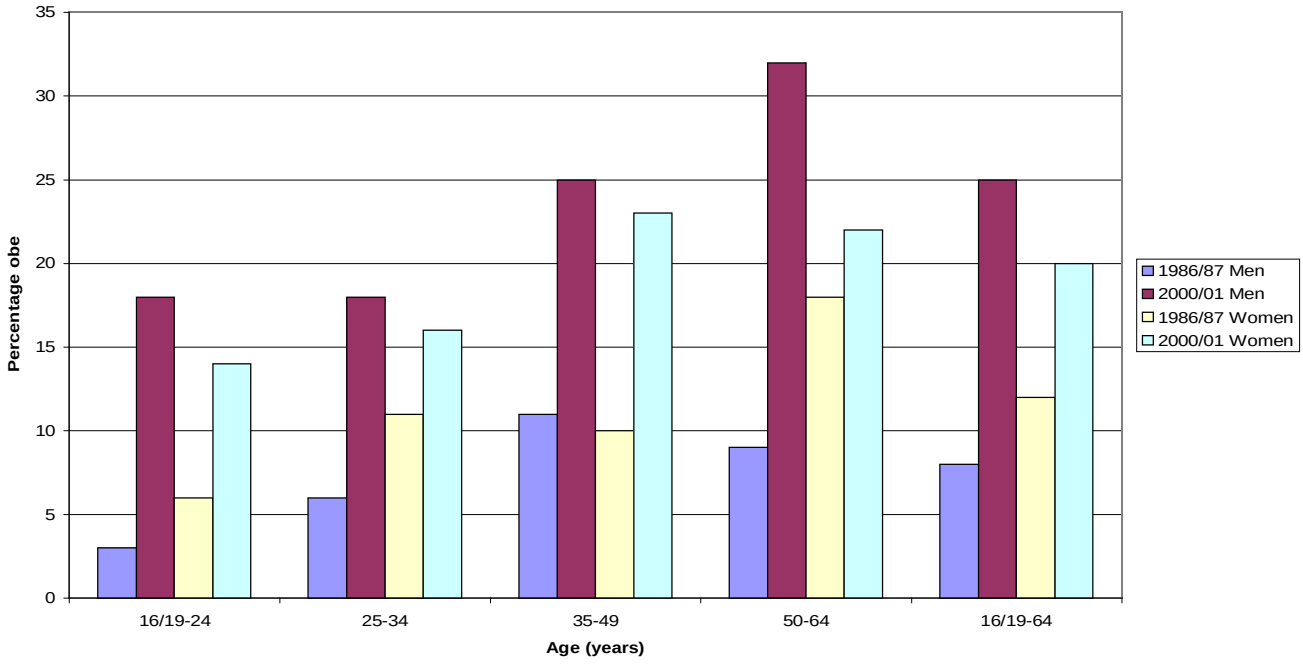
Energy and macronutrient intakes and blood lipids

Adults 19-64 years

Energy intake and body weight (Tables 11 & 12; Figure 4)

33) Mean energy intakes for adults in 2000/01 fell below Estimated Average Requirements (EARs) for men and women in all age groups, and were 80-90% of EAR. However, the increasing prevalence of obesity suggests that energy intakes are generally in excess of requirements rather than inadequate. Data from the two surveys of adults in 1986/87 and 2000/01 showed that the prevalence of obesity or overweight (BMI above 25) had increased from 45% of men and 36% of women who were obese or overweight in 1986/87 to 66% of men and 53% of women in 2000/01. This trend is confirmed by data from the Health Survey for England. Mean energy intakes in the 1986/87 survey were also below EARs. Comparing the 1986/87 and 2000/01 surveys, mean energy intake had fallen slightly in men but was unchanged in women. Interpretation of findings on energy and nutrient intakes should bear in mind the prevalence and degree of under-reporting in the datasets (see para. 9).

Figure 4: Comparison of prevalence of obesity (BMI greater than 30kg/m^2) in adults in 1986/87 and 2000/01
Note: Age range for 1986/87 survey 16-64 years, 2000/01 survey 19-64 years



34) There is evidence of low energy intakes in some younger women and to a lesser extent young men. In the 19-24 age group 10% of women had energy intakes below 4MJ/day (EAR is 8.1MJ/day for this group). Six percent of men in the same age group had energy intakes below 6MJ/day (EAR 10.6MJ/day).

Fat and fatty acids (Table 12; Figure 5)

35) The percentage of food energy from fat in 2000/01 was 35.8% for men and 34.9% for women, close to the DRV of 35% and lower than in 1986/87 (40% for both men and women).

36) The percentage of food energy from saturated fatty acids in 2000/01 was also lower than in 1986/87 - 13% of food energy for men and women in 2000/01 compared with 17% in 1986/87, although intake in 2000/01 was still above the DRV (11% of food energy). Trans fatty acid intake followed a similar pattern and in 2000/01 met the DRV of 2% of food energy.

37) The main source of dietary fat for adults was meat and meat products, followed by cereals and cereal products. The main sources of saturated fat were milk and milk products and meat and meat products, followed by cereals and cereal products.

38) Secondary analysis of the adults 2000/01 dataset[17] to examine the dietary characteristics of high consumers of fat and saturated fat showed differences between high and low consumers of fat and saturated fat in the contribution of food groups to intakes. For example, very high fat consumers (> 39% food energy from fat) derived a higher proportion of their fat intake from cream, cheese, sausages, meat pies, chips, and crisps and savoury snacks, compared with low fat consumers (35% food energy from fat or less).

Blood lipids (Tables 17a-c & 18)

39) The blood lipid data from the 1986/87 and 2000/01 adults surveys presented in Tables 17a-c show evidence of substantial changes in blood lipid levels in this age group, especially in older men. Table 17a shows that mean plasma total cholesterol levels were lower in all age/sex groups in 2000/01 compared with 1986/87 and the proportion with levels below 5.2mmol/l, the cut-off point related to reduced risk of cardiovascular disease, was higher in 2000/01 than in 1986/87. For example, for men mean total plasma cholesterol levels in 2000/01 were 13% lower in the 50-64 age group and 6% lower in the 19-24 age group compared with 1986/87, and for women levels were 11% and 9% lower in the 50-64 and 19-24 age groups respectively. This is a positive change which is at least partially attributable to reductions in the saturated fatty acid content of the diet and has resulted in a significant reduction in cardio-vascular disease risk, particularly in older men. Generally accepted estimates at the population level predict that a decrease of 1% in total cholesterol will reduce cardiovascular disease risk by 1-2%.[18] On this basis these data suggest reduction in risk of around 20% for the 50-64 age group and around 10% in the 19-24 age group for both men and women. It is unclear whether the differences are entirely attributable to changes in the fat content of the diet over this period as there has also been an increase in the use of statins to lower blood lipid levels. However it is thought unlikely that the reduction in plasma total cholesterol is wholly attributable to statins, particularly given the marked fall in saturated fat intake over the same period. The 1986/87 and 2000/01 surveys used different assays for plasma cholesterol and this should be borne in mind when interpreting the results. However the differences in blood lipid levels between men and women and old and young are as expected, which adds weight to the assertion that the differences between the two sets of data represent a genuine decline in blood lipid levels. . Data from the Health Survey for England also shows a drop in mean plasma total cholesterol levels between 1994 and 1998 but there was no significant change between 1998 and 2003.

40) Table 17c shows that mean plasma LDL cholesterol levels were also lower in 2000/01 compared with 1986/87 in adult men and women. This is in line with the fall in plasma total cholesterol discussed above. For example for men mean LDL cholesterol levels in 2000/01 compared with 1986/87 were 16% lower in the 50-64 age group and 4% lower in the 19-24 age group, while for women levels were 13% and 9% lower in the 50-64 and 19-24 groups respectively. A 1% decrease in LDL is estimated to provide a 2% decreased risk of cardiovascular disease [reference needed] so the data from these surveys suggest a reduction in risk of around a third in the 50-64 group and 8% in the 19-24 group. However Table 17(b) also suggests that mean HDL cholesterol levels in younger men and women are slightly lower in 2000/01 compared with 1986/87. A reduction in HDL cholesterol is associated with insulin resistance and obesity. In the 2000/01 survey mean HDL levels in younger men and women tended to be lower than in the oldest group. Conversely, data from the Health Survey for England shows that mean HDL cholesterol for men was marginally higher in 2003 compared with 1998.

41) The ratio of total: HDL cholesterol is considered a predictor of the effects of dietary fatty acids on cardiovascular disease risk. A ratio above 5 is associated with increased risk [reference needed]. Comparing the ratios in the 1986/87 and 2000/01 surveys, for men the ratio was lower in 2000/01 compared with 1986/87 for age groups 25-34, 35-49 and 50-64, indicating a proportional increase in HDL relative to total cholesterol, while in the youngest (19-24) group the ratio was slightly higher in 2000/01, indicating a proportional reduction in HDL. For women there are no clear age differences with the ratio in 2000/01 lower in the youngest and oldest group and higher in the middle two groups. A decrease in the ratio of one unit has been estimated to reduce risk of CVD by 50%[19] so for the 50-64 year old men this equates to a 46.5% reduction in risk, a major impact. However in younger men the ratio has increased, meaning that the proportional decrease in HDL cholesterol is greater than the proportional decrease in LDL cholesterol.

Carbohydrate and non-milk extrinsic sugars (Tables 12 & 13; Figure 5)

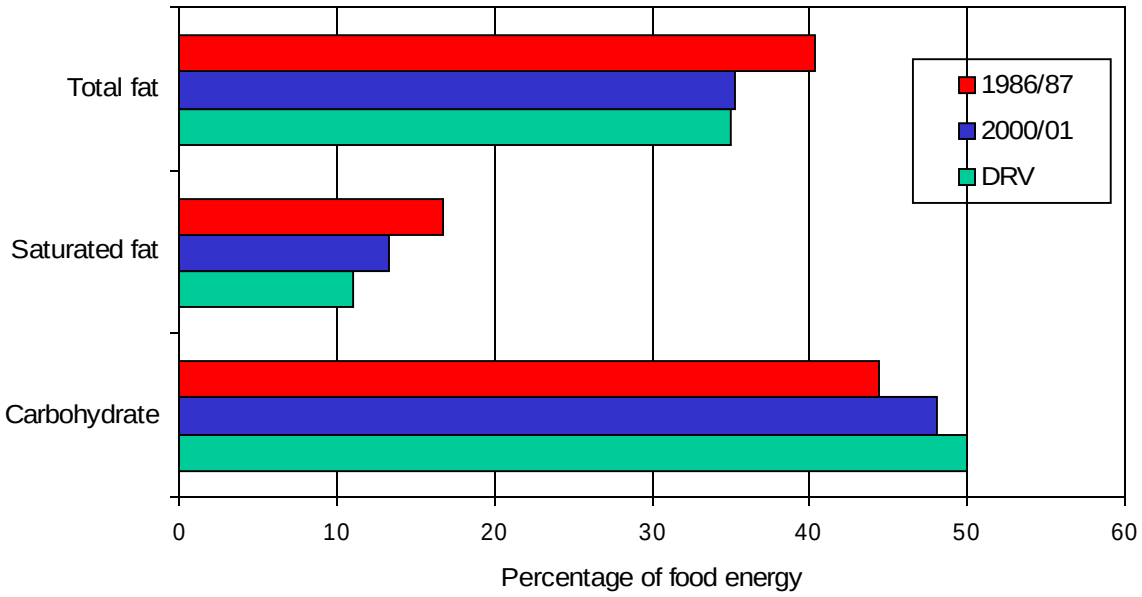
42) The most recent data on adults 19-64 years (2000/01) showed mean intakes of total carbohydrate at 47.7% of food energy for men and 48.5% for women, close to the DRV of 50% and higher than in 1986/87.

43) Mean intake of non-milk extrinsic sugars (NMES) exceeded the DRV of 11% of food energy, at 13.6% for men and 11.9% for women. Intakes were highest in the 19-24 age group in which the mean percentage of food energy derived from NMES was 17.4% for men and 14.2% for women. Intakes at the upper 2.5%ile were almost 30% of food energy.

44) The main single source of NMES for the 19-64 age group overall was table sugar, followed by soft drinks and biscuits, buns, cakes and pastries. In the 19-24 age group soft drinks was the major source and provided over a third of mean intake.

45) Secondary analysis of NDNS adults 2000/01 data to examine the characteristics of high consumers of NMES[17] (>15% food energy from NMES) showed that compared with low NMES consumers (11% or less food energy from NMES), this group derived a higher proportion of their NMES intake from table sugar, confectionery, soft drinks and alcopops. Men in this group also derived a higher proportion of their intake from puddings and beer and lager and women from breakfast cereals, biscuits, buns, cakes and pastries and fruit juice.

Figure 5: Comparison of food energy intakes from total fat, saturated fat and total carbohydrate between 1986/87 and 2000/01 adult surveys.



Non-starch polysaccharides (NSP) (Table 14)

46) Mean NSP intakes in 2000/01 were 15.2g/day for men and 12.6g/day for women, well below the DRV of 18g/day. A third of men and half of women had intakes below 12g per day, the COMA individual minimum. Cereals and cereal products was the main source, providing over 40% of intake. Vegetables and vegetable dishes provided a fifth of intake. It is not possible to compare intakes with the 1986/87 survey of adults as that survey used the Southgate analytical method for dietary fibre.

Alcohol (Tables 15 & 16)

47) In the 2000/01 survey, 60% of men and 44% of women exceeded the recommended daily benchmarks for sensible drinking[x] on at least one of the seven reporting days. Eighteen percent of men and 7% of women exceeded the benchmarks on four or more days of the week, with 3% of men exceeding the benchmark on all seven days. Thirty-nine percent of men and 22% of women drank more than twice the benchmarks on their heaviest drinking day.

48) Alcohol provided 6.5% of total energy intake on average for men and 3.9% for women in the 19-64 age group. There were no significant age differences in the contribution of alcohol to energy intake.

[x] Current advice for adults is that men should drink no more than three to four units of alcohol a day and women no more than two to three units a day. Consistently drinking four or more units a day for men or three or more units a day for women is not advised as a sensible drinking level because of the progressive health risk it carries. One unit is approximately equivalent to half a pint of beer, lager or cider, a single measure of spirits, one small glass of wine or a small glass of sherry, port or other fortified wine. One unit is equivalent to 8 grams alcohol.

Older adults 65 years and over

Energy intake (Table 11)

49) Mean energy intakes were below EARs. In the free-living group mean energy intake was 85% of EAR in men and 76% in women and for men was lowest in the 85+ age group.

50) In the institution group mean energy intake was about 90% of the EAR.

Fat and fatty acids (Table 13)

51) In the free-living group, mean fat intakes were just above the DRV at 35.7% of food energy for men and 36.1% for women. Saturated fat intakes were well above the DRV at 15% of food energy intake. Trans fatty acid intakes met the DRV. The main sources of total fat were cereals and cereal products, meat and meat products and fat spreads, each contributing about a fifth of intake. Milk and milk products was the main source of saturated fat, followed by cereals and meat.

52) In the institution group mean fat intake in men was close to the DRV and in women met the DRV. Saturated fat intakes were well above the DRV at 15% of food energy intake. Trans fatty acid intakes met the DRV. Meat and meat products made less contribution to fat intake than in the free-living group. The main sources of total fat were cereals, milk and fat spreads, and of saturated fat were milk, cereals and fat spreads.

Blood lipids (Table 17a-c)

53) Overall 34% of men and 24% of women in the free-living group and 62% of men and 43% of women in the institution group had a plasma total cholesterol concentration below 5.2mmol/l. Severely elevated levels (>7.8mol/l) were found in 3% of men and 14% of women in the free-living group and about 1% of men and women in the institution group. In the free-living group mean total cholesterol levels decreased with age in men but not women. Mean LDL cholesterol concentrations also decreased with age for men in both groups.

Carbohydrate and non-milk extrinsic sugars (NMES) (Table 13)

54) Total carbohydrate intake in the free-living group was 48% of food energy intake, close to the DRV and similar to the 19-64 group. NMES intake in men exceeded the DRV at 13% of food energy and in women was just above the DRV.

55) In the institution group total carbohydrate intake was higher than in the free-living group and met the DRV, at 51% of food energy intake for both men and women. This was largely due to the higher intake of NMES in this group, 17.9% and 18.5% of food energy in men and women respectively. Sugars, preserves and confectionery contributed about half the total intake; table sugar was the largest single contributor. Buns, cakes, pastries and puddings provided another fifth of intake and 9% came from drinks.

56) Sugar, preserves and confectionery was the main source of NMES intake in both the free-living and institution groups, providing over 40% of intake in the free-living group and about half in the institution group. Table sugar was the largest single contributor. Cereals provided around 30% of intake.

Non-starch polysaccharides (NSP) (Table 14)

57) Mean NSP intakes were below the DRV of 18 grams/day in both groups. Intake in the institution group was lower than in the free-living group.

Alcohol (Table 15)

58) In the free-living group the percentage of total energy intake derived from alcohol was 4% for men and 1% for women. Reported alcohol consumption and the percentage of total energy derived from alcohol was lower in the institution group than in the free-living group.

Children and young people 1½-18 years

Energy intake (Table 11)

59) Mean energy intakes were below the EARs in all groups. In girls aged 15-18 years mean energy intake was 77% of the EAR and in other groups 80-90% of EAR.

Fat and fatty acids (Table 13)

60) The mean percentage of food energy from total fat was above the DRV in all age groups, at about 36% on average. Mean intake of saturated fat was 17% of food energy in the 1½-2½ year group and declined with age to 15% of food energy in the 4-6 year group and 14% in the oldest group. Trans fatty acid intakes met the DRV in all age groups. Milk and milk products was the main source of total fat and saturated fat in the 1½-4½ group, providing over a quarter of total fat and over a third of saturated fat. In older children cereals and cereal products, meat and meat products and vegetables, potatoes and savoury snacks replaced milk as the main source of fat. The main sources of saturated fat in older children were milk, cereals and meat.

Carbohydrate and non-milk extrinsic sugars (Table 13)

61) Mean intakes of total carbohydrate met the DRV for all age groups.

62) Mean NMES intakes exceeded the DRV in all age groups. The 1½-4½ year age group had the highest mean intakes at 18.8% of food energy for boys and 18.6% for girls. In older children mean intakes were at 16-17% of food energy and there was a wide range of intakes, from 5-8% of food energy at the lower 2.5 percentile to 26-31% at the upper 2.5 percentile. In the youngest children intakes at the upper 2.5 percentile were 35-37% of energy. Soft drinks (mainly carbonated) was the single largest contributor to NMES intake in all age groups, providing a quarter to a third of intake on average. Sugar, preserves and confectionery contributed around 30% of intake and cereals and cereal products (including biscuits, buns, cakes and pastries) 25%. The contribution of soft drinks increased with age, carbonated soft drinks alone provided 28% of NMES intake for boys aged 15-18. The contribution of cereals and cereal products tended to fall with age.

Non-starch polysaccharides (NSP) (Table 14)

63) Mean NSP intakes in all age groups were below the DRV of 18g/day for adults. Intakes increased with age from 6g/day in the 1½-4½ age group to 13g in boys and 11g in girls in the 15-18 age group.

Alcohol (Table 15)

64) In the 15-18 age group 1.9% of energy intake for boys and 1.4% for girls was derived from alcohol. Alcohol consumption reported in the dietary interview was 9 units[xi] per week for boys and 7 units per week for girls. Consumption in the 11-14 group was reported at 0.5 units per week.

Overview of energy and macronutrient intakes

65) Mean energy intakes fell below EARs in all age/sex groups. The difference between reported energy intakes and EARs is likely to arise from a combination of factors including mis-reporting and the possible overestimation of energy requirements due to a decrease in physical activity levels.

66) Fat intakes were generally just above the DRV and met the DRV for women aged 19-64 and women aged 65 and over living in an institution. Saturated fat intakes exceeded the DRV in all groups. Milk, cereals and meat were the major sources of fat and saturated fat, the contribution of milk decreasing with age, and that of meat increasing.

67) The percentage of food energy derived from carbohydrate met or was close to meeting the DRV of 50% in all age groups. Intakes in children and older people in institutions are above the DRV although this is largely due to the high consumption of NMES in these age groups. NMES intake exceeded the DRV in all age groups and was highest in children and older people in institutions. Soft drinks were the major source of NMES in children and young adults and table sugar in older adults.

68) All groups had mean protein intakes above the Reference Nutrient Intake levels. Protein intake as a percentage of the RNI declined with age from 244% in 1½-4½ year old children to 120% in free-living older women.

69) Intake of non-starch polysaccharides was low overall and no groups met the DRV for adults.

70) Alcohol made a significant contribution to energy intake in some consumers and a substantial proportion of adults exceeded the sensible drinking recommendations.

[xi] One unit is approximately equivalent to half a pint of beer, lager or cider, a single measure of spirits, one small glass of wine (125 mls) or a small glass of sherry, port or other fortified wine. One unit is equivalent to 8 grams alcohol.

Table 11: Average daily total energy intake (MJ) as a percentage of the estimated average requirement (EAR) by sex and age of respondent**

Gender and age of respondent	Mean energy intake (MJ)	Intake as % EAR**	*Number of subjects*†
Males and females aged 1½-2½ years***	4.39	90%	*538*
Males and females aged 2½-3½ years***	4.88	84%	*578*
Males aged (years)			
3½-4½***	5.36	82%	*250*
4 – 6	6.39	89%	*184*
7 – 10	7.47	91%	*256*
11- 14	8.28	89%	*237*
15 – 18	9.60	83%	*179*
19 – 24	9.44	89%	*61*
25 – 34	9.82	93%	*160*
35 – 49	9.93	94%	*303*
50 – 64	9.55	92%	*242*
65+ *Free-living*	8.02	85%	*632*
65+ *Living in an institution*	8.14	91%	*204*
Females aged (years)			
3.5-4.5***	4.98	82%	*243*
4 – 6	5.87	91%	*171*
7 – 10	6.72	92%	*226*
11- 14	7.03	89%	*238*
15 –18	6.82	77%	*210*
19-24	7.00	86%	*78*
25-34	6.61	82%	*211*
35-49	6.96	86%	*379*
50-64	6.91	87%	*290*
65+ *Free-living*	5.98	76%	*643*
65+ *Living in an institution*	6.94	90%	*208*

** Standard EAR values used for each age/sex group as published in the UK Dietary Reference Values.[11] EAR values for each age/sex group were derived from BMR calculated from the modified Schofield equations using mean body weight values for each age/sex group. PAL for adults taken as 1.4. The Estimated Average Requirements (EARs) for energy used are:

Men:	Women:
4-6 years: 7.16 MJ/day	6.46 MJ/day
7-10 years: 8.24 MJ/day	7.28 MJ/day
11-14 years 9.27 MJ/day	7.92 MJ/day
15-18 years 11.51 MJ/day	8.83 MJ/day
19 to 50 years: 10.60MJ/d	19 to 50 years: 8.10MJ/d
51 to 59 years: 10.60MJ/d	51 to 59 years: 8.00MJ/d
60 to 64 years: 9.93MJ/d	60 to 64 years: 7.99MJ/d

Energy intake as a percentage of EAR was calculated for each respondent using the EAR appropriate for sex and age.

*** Energy intakes per kilogram body weight were compared with EAR per kg body weight to calculate Intake as % of EAR.

Table 12: Macronutrient intakes for adults in 1986/87 and 2000/01

Macronutrient	1986/87 Adults survey 16-64 years	2000/01 NDNS Adults 19-64 years	Dietary Reference Value[10] (population average)
Men			
Mean daily total energy intake (kcal)	2450	2313	2550 (19-59yrs) 2380 (60-64yrs)
% food energy from total carbohydrate	44.7	47.7	50%
% food energy from non-milk extrinsic sugars	n/a	13.6	No more than 11%
% food energy from protein	15.2	16.5	n/a
Mean protein intake as % RNI	154	161	RNI 55.5g/day (19-50 yrs) 53.3g/day (50+ yrs)
% food energy from total fat	40.4	35.8	No more than 35%
% food energy from saturated fatty acids	16.5	13.4	No more than 11%
% food energy from trans unsaturated fatty acids	2.2	1.2	No more than 2%
% food energy from cis monounsaturated fatty acids	12.4	12.1	Population average 13%
% food energy from cis n-3 polyunsaturated fatty acids	0.8	1	
% food energy from cis n-6 polyunsaturated fatty acids	5.4	5.4	
Women			
Mean daily total energy intake (kcal)	1680	1632	1940 (19-50yrs)
% food energy from total carbohydrate	44.2	48.5	50%
% food energy from non-milk extrinsic sugars	n/a	11.9	No more than 11%
% food energy from protein	15.6	16.6	n/a
Mean protein intake as % RNI	137	140	RNI 45.0g/day (19-50 yrs) 46.5g/day (50+ yrs)
% food energy from total fat	40.3	34.9	No more than 35%
% food energy from saturated fatty acids	17	13.2	No more than 11%
% food energy from trans unsaturated fatty acids	2.2	1.2	No more than 2%
% food energy from cis monounsaturated fatty acids	12.2	11.5	13%
% food energy from cis n-3 polyunsaturated fatty acids	0.8	1	
% food energy from cis n-6 polyunsaturated fatty acids	5.3	5.3	

Table 13: Percentage of food energy from total carbohydrate, non-milk extrinsic sugars (NMES), protein, total fat, saturated fatty acids and trans fatty acids and comparison with COMA Dietary Reference Values (DRVs)

Gender and age	Percentage food energy from:						*No of subjects (unweighted)*
	Total carbohydrate	NMES	Protein	Total fat	Saturated fatty acids	Trans fatty acids	
Males aged (years)							
1.5-4.5	51.4	18.8	12.8	35.7	16.2	1.7	*848*
4 – 6	51.6	16.2	12.9	35.5	14.8	1.3	*184*
7 – 10	52.4	17.5	12.4	35.2	14.3	1.4	*256*
11 – 14	51.7	16.9	13.1	35.2	13.8	1.3	*237*
15 –18	50.5	15.8	13.9	35.9	13.9	1.4	*179*
19 – 24	49.0	17.4	14.9	36.0	13.5	1.2	*61*
25 – 34	47.7	13.9	16.5	35.8	13.2	1.2	*160*
35 – 49	47.5	13.1	16.7	35.9	13.5	1.2	*303*
50 – 64	47.4	12.2	17.0	35.6	13.4	1.2	*242*
65+ Free -living	48.2	13.2	16.1	35.7	14.6	1.5	*632*
65+ Living in an institution	50.8	17.9	14.1	35.1	15.2	1.7	*204*
Females aged (years)							
1.5-4.5	50.8	18.6	13.1	36.1	16.2	1.7	*827*
4 – 6	51.4	17.6	12.7	35.9	15.3	1.3	*171*
7 – 10	51.3	16.7	12.8	35.9	14.5	1.4	*226*
11 – 14	51.2	16.2	12.7	36.1	14.0	1.3	*238*
15 –18	50.6	15.3	13.9	35.9	13.8	1.3	*210*
19 – 24	49.1	14.2	15.4	35.5	12.9	1.1	*78*
25 – 34	48.7	11.8	15.9	35.4	13.2	1.1	*211*
35 – 49	48.6	11.8	16.7	34.7	13.2	1.2	*379*
50 – 64	48.1	11.0	17.4	34.5	13.3	1.2	*290*
65+ *Free-living*	47.5	11.5	16.5	36.1	15.3	1.6	*643*
65+ *Living in an institution*	51.3	18.5	14.0	34.8	15.4	1.8	*208*

Dietary reference values (DRVs) are:
Total carbohydrate should make up more than 50% of food energy intake
NMES should make up less than 11% of food energy intake
Total fat should make up less than 35% of food energy intake
Saturated fats should make up less than 11% of food energy intake
Trans fatty acids should make up less than 2% of food energy intake

Table 14: Mean non-starch polysaccharides intake (grams per day)

Gender and age	Mean intake (g)	*Number of subjects (unweighted)*
Males aged (years)		
1.5-4.5	6.3	*848*
4 – 6	9.1	*184*
7 – 10	10.3	*256*
11 – 14	11.6	*237*
15 –18	13.3	*179*
19 – 24	12.3	*61*
25 – 34	14.6	*160*
35 – 49	15.7	*303*
50 – 64	16.4	*242*
65+ *Free-living*	13.5	*632*
65+ *Living in an institution*	11.0	*204*
Females aged (years)		
1.5-4.5	5.9	*827*
4 – 6	8.0	*171*
7 – 10	9.8	*226*
11 – 14	10.2	*238*
15 –18	10.6	*210*
19 – 24	10.6	*78*
25 – 34	11.6	*211*
35 – 49	12.8	*379*
50 – 64	14.0	*290*
65+ *Free-living*	11.0	*643*
65+ *Living in an institution*	9.5	*208*

Table 15: Alcohol consumption

Gender and age	% total energy from alcohol*	Mean weekly alcohol consumption (units)**	*Number of subjects (unweighted)*†
Males aged (years)			
11-14	0.0	0.5	*237*
15-18	1.9	9.1	*179*
19-24	6.0	27.8	*61*
25-34	6.6	21.6	*160*
35-49	6.8	20.7	*303*
50-64	6.4	18.3	*242*
65+ *Free-living*	4.0	N/a	*632*
65+ *Living in an institution*	0.9	N/a	*204*
Females aged (years)			
11-14	0.1	0.5	*238*
15-18	1.4	6.7	*210*
19-24	4.6	16.2	*78*
25-34	4.0	10.0	*211*
35-49	3.9	8.0	*379*
50-64	3.7	6.5	*290*
65+ *Free-living*	1.3	N/a	*643*
65+ *Living in an institution*	0.2	N/a	*208*

* Data from 7- day dietary record includes alcohol consumed as part of recipe dishes.
** Data from interview.
† Number of subjects based on 7-day dietary record
N/a – data not available

Table 16: Number of days on which units of alcohol consumed exceeded the recommended daily benchmarks

Number of days on which units of alcohol consumed exceeded the recommended daily benchmarks	Aged 19-64	
	Men	Women
	%	%
0	40	56
1	18	18
2	14	11
3	10	7
4	6	4
5	6	2
6	3	1
7	3	0
Number of subjects (unweighted)	*766*	*958*

Table 17(a) Percentage distribution of plasma total cholesterol by sex and age of respondent

	Males aged (years)												
Total cholesterol	**1986/87 Adults Survey**				**2000/01 NDNS**				**Free-living participants**			**Institution participants**	
(mmol/l)	**18-24**	**25-34**	**35-49**	**50-64**	**19-24**	**25-34**	**35-49**	**50-64**	**65-74**	**75-84**	**85 & over**	**65-84**	**85 & over**
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Less than 5.20	*75*	*41*	*21*	*13*	*84*	*59*	*44*	*41*	*29*	*39*	*60*	*55*	*73*
Less than 7.80	*100*	*96*	*91*	*90*	*100*	*98*	*98*	*98*	*96*	*97*	*100*	*99*	*100*
Mean (average)	4.7	5.5	6.1	6.4	4.40	5.04	5.38	5.56	5.75	5.37	4.84	5.07	4.39
Median	4.6	5.5	6.0	6.3	4.29	4.93	5.41	5.56	5.70	5.40	4.80	4.92	4.25
Upper 2.5%ile	*6.4	*7.4	*8.1	*8.3	6.33	7.80	7.47	7.76	8.10	7.75	7.25	7.34	6.32
Lower 2.5%ile	*3.4	*4.0	*4.6	*4.8	3.20	2.99	3.06	3.35	3.56	2.97	2.18	2.95	2.10
Number of subjects (unweighted)	*139*	*216*	*317*	*251*	*45*	*115*	*243*	*189*	*200*	*191*	*67*	*82*	*54*

	Females aged (years)												
Total cholesterol	**1986/87 Adults Survey**				**2000/01 NDNS**				**Free-living participants**			**Institution participants**	
(mmol/l)	**18-24**	**25-34**	**35-49**	**50-64**	**19-24**	**25-34**	**35-49**	**50-64**	**65-74**	**75-84**	**85 & over**	**65-84**	**85 & over**
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Less than 5.20	*66*	*61*	*35*	*10*	*83*	*68*	*52*	*25*	*24*	*23*	*27*	*42*	*44*
Less than 7.80	*98*	*99*	*97*	*79*	*100*	*99*	*99*	*91*	*85*	*86*	*90*	*99*	*99*
Mean (average)	4.9	5.1	5.7	6.8	4.46	4.84	5.13	6.06	6.24	6.30	5.95	5.60	5.36
Median	4.8	5.0	5.6	6.8	4.55	4.69	5.16	6.05	6.09	6.29	5.83	5.45	5.29
Upper 2.5%ile	*6.7	*6.3	*7.4	*9.0	6.04	6.92	7.17	8.69	9.27	9.85	8.25	7.52	7.52
Lower 2.5%ile	*3.6	*3.9	*4.1	*4.9	2.83	3.01	3.44	4.16	3.74	3.06	3.07	2.90	2.90
Number of subjects (unweighted)	*84*	*170*	*315*	*240*	*47*	*154*	*296*	*206*	*178*	*150*	*100*	*55*	*57*

* Values for 1986/87 are 5.0 percentile

Table 17(b) Percentage distribution of plasma high-density lipoprotein (HDL) cholesterol by sex and age of respondent

	Males aged (years)												
HDL cholesterol	**1986/87 Adults Survey**				**2000/01 NDNS**				**Free-living participants**			**Institution participants**	
(mmol/l)	**18-24**	**25-34**	**35-49**	**50-64**	**19-24**	**25-34**	**35-49**	**50-64**	**65-74**	**75-84**	**85 & over**	**65-84**	**85 & over**
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Less than 1.00	*27*	*36*	*31*	*39*	*43*	*44*	*46*	*42*	*41*	*38*	*41*	*56*	*59*
Less than 1.20	*63*	*58*	*64*	*65*	*77*	*77*	*77*	*69*	*58*	*59*	*56*	*78*	*68*
Less than 1.40	*85*	*76*	*81*	*81*	*92*	*91*	*89*	*84*	*78*	*78*	*73*	*84*	*94*
Less than 1.60	*94*	*89*	*90*	*91*	*100*	*98*	*95*	*92*	*85*	*85*	*88*	*94*	*98*
Mean (average)	1.1	1.2	1.2	1.1	1.06	1.04	1.04	1.12	1.17	1.19	1.14	0.99	0.97
Median	1.1	1.1	1.1	1.1	1.07	1.02	1.01	1.04	1.09	1.10	1.06	0.94	0.87
Upper 2.5%ile	*1.62	*1.76	*1.84	*1.76	1.49	1.58	1.87	1.85	2.32	2.28	1.95	1.80	1.49
Lower 2.5%ile	*0.74	*0.73	*0.73	*0.63	0.68	0.61	0.56	0.64	0.52	0.58	0.58	0.46	0.45
Number of subjects (unweighted)	*139*	*214*	*315*	*251*	*45*	*115*	*243*	*189*	*200*	*191*	*67*	*82*	*53*

	Females aged (years)												
HDL cholesterol	**1986/87 Adults Survey**				**2000/01 NDNS**				**Free-living participants**			**Institution participants**	
(mmol/l)	**18-24**	**25-34**	**35-49**	**50-64**	**19-24**	**25-34**	**35-49**	**50-64**	**65-74**	**75-84**	**85 & over**	**65-84**	**85 & over**
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Less than 1.00	*15*	*9*	*12*	*10*	*24*	*20*	*22*	*18*	*18*	*17*	*21*	*38*	*36*
Less than 1.20	*35*	*29*	*32*	*29*	*52*	*42*	*45*	*38*	*38*	*33*	*40*	*53*	*63*
Less than 1.40	*66*	*50*	*52*	*50*	*76*	*68*	*71*	*64*	*59*	*52*	*53*	*66*	*78*
Less than 1.60	*84*	*72*	*71*	*70*	*90*	*86*	*84*	*79*	*72*	*71*	*76*	*77*	*84*
Mean (average)	1.3	1.4	1.4	1.4	1.21	1.26	1.27	1.34	1.39	1.41	1.35	1.26	1.19
Median	1.3	1.4	1.4	1.4	1.18	1.24	1.24	1.31	1.29	1.35	1.33	1.11	1.10
Upper 2.5%ile	*1.80	*2.01	*2.09	*2.19	1.71	1.97	2.34	2.36	2.58	2.36	2.22	2.69	2.05
Lower 2.5%ile	*0.88	*0.92	*0.89	*0.83	0.75	0.66	0.70	0.69	0.71	0.71	0.59	0.66	0.63
Number of subjects (unweighted)	*82*	*170*	*314*	*240*	*47*	*154*	*296*	*206*	*178*	*150*	*100*	*56*	*57*

* Values for 1986/87 are 5.0 percentile

Table 17(c) Percentage distribution of plasma low-density lipoprotein (LDL) cholesterol by sex and age of respondent

	Males aged (years)					
LDL cholesterol	**1986/87 Adults Survey**	**2000/01 NDNS**	**Free-living participants**	**Institution participants**		

(mmol/l)	18-24 %	25-34 %	35-49 %	50-64 %	19-24 %	25-34 %	35-49 %	50-64 %	65-74 %	75-84 %	85 & over %	65-84 %	85 & over %
Less than 3.40	45	22	8	3	60	30	23	18	13	25	41	27	49
Less than 4.10	75	44	25	16	81	61	42	39	32	47	64	52	79
Mean (average)	3.5	4.3	5.0	5.3	3.35	4.00	4.34	4.44	4.58	4.17	3.69	4.08	3.42
Median	3.5	4.3	4.8	5.3	3.18	3.84	4.39	4.37	4.52	4.16	3.60	3.84	3.28
Upper 2.5%ile	*5.2	*6.4	*7.2	*7.3	5.37	6.77	6.78	6.64	7.06	6.71	6.40	6.35	5.25
Lower 2.5%ile	*2.2	*2.7	*3.2	*3.5	1.84	1.86	2.00	2.25	2.26	1.82	1.32	2.03	0.94
Number of subjects (unweighted)	*139*	*214*	*315*	*251*	*45*	*115*	*243*	*189*	*200*	*191*	*67*	*82*	*53*

LDL cholesterol	Females aged (years)												
	1986/87 Adults Survey				2000/01 NDNS				Free-living participants			Institution participants	
(mmol/l)	18-24 %	25-34 %	35-49 %	50-64 %	19-24 %	25-34 %	35-49 %	50-64 %	65-74 %	75-84 %	85 & over %	65-84 %	85 & over %
Less than 3.40	47	40	19	5	57	49	35	13	19	14	18	13	33
Less than 4.10	79	75	46	16	86	77	63	31	30	32	33	46	50
Mean (average)	3.6	3.7	4.3	5.4	3.26	3.57	3.85	4.72	4.85	4.89	4.59	4.34	4.17
Median	3.5	3.5	4.2	5.3	3.24	3.43	3.79	4.59	4.84	4.59	4.63	4.36	4.06
Upper 2.5%ile	*5.4	*5.1	*6.1	*7.7	4.98	5.84	6.00	7.22	7.73	8.58	6.75	6.23	6.53
Lower 2.5%ile	*2.3	*2.6	*2.8	*3.4	1.86	1.94	2.20	2.71	2.30	1.65	1.73	1.88	1.91
Number of subjects (unweighted)[†]	*82*	*170*	*314*	*240*	*47*	*154*	*296*	*206*	*178*	*150*	*100*	*55*	*57*

*Values for 1986/87 are 5.0 percentile.

Table 18 Percentage distribution of plasma total cholesterol to HDL cholesterol ratio by sex and age of respondent

Total cholesterol to HDL cholesterol ratio	Males aged (years)									
	1986/87 Adults Survey					2000/01 NDNS				
	19-24	25-34	35-49	50-64	All	19-24	25-34	35-49	50-64	All
Less than 5.0	*75*	*57*	*41*	*31*	*47*	*74*	*56*	*46*	*44*	*49*
Mean (average)	4.34	5.17	5.65	6.31	5.55	4.40	4.99	5.51	5.38	5.28
Median	4.10	4.59	5.35	6.05	5.17	4.04	4.65	5.26	5.24	5.03
Lower 2.5%ile	2.40	2.82	2.79	3.12	2.73	2.40	2.20	2.51	2.37	2.48
Upper 2.5%ile	7.61	9.81	10.07	12.16	10.29	8.20	8.49	10.36	9.11	9.32
Number of subjects (unweighted)	*112*	*199*	*297*	*240*	*848*	*46*	*114*	*237*	*183*	*580*
Total cholesterol to HDL cholesterol ratio	**Females aged (years)**									
	1986/87 Adults Survey					2000/01 NDNS				
	19-24	25-34	35-49	50-64	All	19-24	25-34	35-49	50-64	All
Less than 5.0	*82*	*85*	*78*	*55*	*74*	*89*	*80*	*74*	*58*	*72*
Mean (average)	4.09	3.84	4.31	5.12	4.39	3.85	4.09	4.34	4.88	4.41
Median	3.96	3.58	3.99	4.85	4.03	3.68	3.75	4.01	4.57	4.07
Lower 2.5%ile	2.57	2.46	2.51	2.68	2.53	2.34	2.32	2.25	2.52	2.33
Upper 2.5%ile	7.22	6.65	7.85	9.54	7.95	6.57	8.23	8.24	8.92	8.41
Number of subjects (unweighted)	*90*	*217*	*324*	*240*	*871*	*47*	*152*	*293*	*200*	*692*

Micronutrient intakes and status

71) The surveys collected data on intakes of vitamins and minerals estimated from food consumption records over a seven-day period and on status measures for some vitamins and minerals from analysis of blood samples taken, usually within two weeks of the dietary recording period. Status measures are available for most vitamins for which intakes were assessed, but not minerals, with the exception of iron.

72) Associations between intake measures and nutritional status measures are generally weak for most micronutrients. There are a number of reasons for this. Many measures of nutritional status indicate long-term body stores and do not reflect short-term intakes, e.g. retinol.[19] In other cases there are physiological reasons why intake is not directly related to status, e.g. iron status is affected by controls on intestinal absorption, variation in bioavailability and in women, menstrual blood loss[20].

73) The analytical methods used for individual nutritional status measures are generally comparable between the NDNS surveys. Where there is doubt about comparability this has been highlighted. Thresholds used to define adequate nutritional status were those current at the time of the survey.

74) It is not possible to make comparisons of nutritional status between the 2000/01 and the 1986/87 surveys of adults because of differences in the analytical methods used.

Adults 19-64 years

Vitamins (Tables 19,22 & 23)

75) Mean intakes of all vitamins were above the Reference Nutrient Intakes (RNI) for men and women overall (taking all ages together).

76) There was some evidence of low intakes of vitamin A and riboflavin in younger age groups (Table 19). Mean intakes of vitamin A fell below the RNI for men and women aged 19-24. Intakes below the Lower Reference Nutrient Intake (LRNI) were found in 16% of men and 19% of women in the 19-24 age group and 7% of men and 11% of women in the 25-34 group. The main sources of vitamin A were meat and meat products and vegetables. Plasma retinol levels, which indicate long term status and do not reflect recent vitamin A intake, were above threshold levels[20] except for 1% of men aged 50-64 years who had marginal status.

77) Mean riboflavin intakes were above the RNI in all age/sex groups but intakes below the LRNI were found in 8% and 15% of 19-24 year old men and women respectively and in 10% of women aged 25-34. The main sources of riboflavin were milk and milk products and cereals and cereal products (mainly from fortified breakfast cereals). A high proportion of adults had marginal status levels for riboflavin based on the EGRAC index[22xii].

[xii] Erythrocyte Glutathione Reductase Activation Co-efficient (EGRAC) is a measure of red cell enzyme saturation with its riboflavin-derived –co-factor, flavin adenine dinucleotide. There are issues with the activation coefficient used to define those subjects who have marginal riboflavin status. An activation coefficient of >1.2 was originally proposed to define marginal riboflavin status (Glatzle *et al.*, 1970). Subsequent revisions to the methodology (Thurnham *et al.*, 1972; Thurnham & Rathakette, 1982) resulted in a systematic increase in activation coefficients and the adoption of an activation coefficient of >1.3 to define marginal riboflavin status. Further increases in activation coefficients may have occurred as a consequence of methodological changes to the EGRAC assay and the activation coefficient used to define marginal riboflavin status should be re-evaluated.

78) Mean intakes of folate were above the RNI in all age/sex groups and no more than 3% of any age group had intakes below the LRNI. However only 14% of women aged 19-24 years, 8% of the 25-34 year group and 16% of the 35-49 group had a folate intake of 400µg/day or more, including intake from supplements[xiii]. The main dietary source of folate was cereals and cereal products, which provided a third of intake. Five percent of men and women had a red cell folate concentration indicative of marginal status with increased risk of deficiency[23]. This increased to 8% of the 19-24 year old women and 13% of the 19-24 year old men. No more than 1% of any age/sex group had a red cell folate concentration indicating severe deficiency (Tables 19 & 22).

79) Five percent of men and 3% of women had plasma vitamin C levels below 11µmol/l indicating biochemical depletion[24]. The proportion with vitamin intakes below the LRNI was below 0.5%.

80) Low vitamin D status (plasma hydroxy vitamin D level below 25nmol/l)[25] was found in around 15% of the adult population overall and a quarter of the 19-24 age group (24% of men and 28% of women). The proportion with low status was higher during the winter months. This threshold for low vitamin D status has been questioned recently and there is currently no consensus[26]. No RNI has been set for vitamin D in adults aged under 50 years.

Minerals (Tables 20 & 21)

81) Mean intakes of most minerals were above the RNIs for men and women overall (taking all age groups together). However there was evidence of low intakes of a number of minerals, including potassium, magnesium, zinc, and, for women, iron, calcium, copper and iodine, especially in the younger age groups.

82) Mean iron intakes in women were well below the RNI in all but the 50-64 age group. In the 19-24 and 25-34 groups over 40% had intakes below the LRNI. Cereals and cereal products was the main food source, providing over 40% of average intake. Under a fifth of intake came from meat and meat products on average for the group as a whole. Eight percent of women and 3% of men overall had haemoglobin levels below the WHO thresholds defining anaemia[27]. Eleven percent of women and 4% of men had serum ferritin levels below the normal range[28], increasing to 16% of women in the 19-24 group.

83) Mean potassium intakes were below the RNI in all age groups for women and in the youngest men (19-24). Intakes below the LRNI were found in 30% of women aged 19-34 and 18% of men aged 19-24.

84) Mean intakes of magnesium were below the RNI for women in all age groups and men in the youngest group. Nine percent of men and 13% of women had intakes below the LRNI, increasing to 17% of men aged 19-24 and around a fifth of women in the 19-24 and 25-34 age groups. Cereals and cereal products was the main source, followed by drinks. Beer and lager was a significant source for men.

85) Mean intakes of zinc were close to or above the RNI in all age / sex groups. Intakes below the LRNI were found in 7% and 5% of the youngest men and women

[xiii] The Department of Health currently recommend that those women who could become pregnant take a supplement of 400µg folic acid per day prior to conception and until the twelfth week of pregnancy in order to minimise the risk of neural tube defects.

respectively. About a third of intake came from meat, a quarter from cereals and a sixth from milk.

86) Five percent of men and 8% of women in the youngest 19-24 age group had calcium intakes below the LRNI. Milk and milk products provided over 40% of average intake, and cereals 30%.

87) Twelve percent of women in the 19-24 age group had iodine intakes below the LRNI. Milk and milk products provided over 40% of intake for women and fish 12% of intake. Mean copper intakes fell below the RNI for women in all age groups. For adults as a group, around a third of copper intake came from cereals and a sixth of intake from meat.

Older adults 65 years and over

Vitamins (Tables 19,22 & 23)

88) Mean intakes of almost all vitamins were above RNIs in the free-living and institution groups. However there was evidence of intakes below the LRNI for a number of vitamins in the free-living group, including riboflavin, folate, and vitamin A, particularly in women and in the oldest group, aged 85 and over. Eleven percent of women in the free-living group aged 85 and over had folate intakes below the LRNI, 15% fell below the LRNI for riboflavin, 6% for vitamin B_6 and 4% for vitamin C, vitamin A and vitamin B_{12}.

89) There was also evidence of low status for these vitamins. Fifteen percent of the free-living group had serum folate concentrations below the normal range[23]. Eight percent had red cell folate concentrations indicating severe deficiency while 21% had a marginal status. Low plasma vitamin C levels, indicating biochemical depletion, were found in 14% overall and about a fifth of the oldest free-living men and women. Over 40% overall had EGRAC levels indicating marginal riboflavin status[xiv].

90) Vitamin D intakes were below the RNI in all groups. Overall, 6% of men and 10% of women in the free-living group had low vitamin D status based on the threshold of low status of plasma hydroxy vitamin D below 25nmol/l.[25,26] This increased in the winter months.

91) In the institution group there was also some evidence of low intakes of riboflavin and folate especially in the oldest women. There was also a higher proportion with low status for some vitamins than in the free-living group. Mean serum folate concentration was significantly lower than in the free-living group and 39% of participants had a concentration below 7nmol/l. Sixteen percent of the group overall had red cell folate levels indicating severe deficiency while 29% of men and 15% of women had marginal status. Low vitamin C status was found in around 40% of participants and low riboflavin status in 41% of men and 32% of women.

92) Vitamin D status was significantly lower in the institution group than in the free-living group. Over a third of men and women had low status though there was no evidence of seasonal variation. Vitamin D intakes from food sources were below the RNI in almost all participants and the contribution from supplements was low.

[xiv] There are issues with the activation coefficient used to define those subjects who have marginal riboflavin status.

Minerals (Tables 20 & 21)

93) Taking the age groups together, mean intakes of potassium and magnesium fell below the RNI for men and women in the free-living group and additionally copper for women. Magnesium intakes below the LRNI were found in a fifth of the free-living group overall and over a third of the oldest group. Potassium intakes below the LRNI were found in 17% of men and 39% of women, increasing to 57% of women aged 85 and over.

94) Low iron intakes were found in 6% of women overall and 10% aged 85 and over. Although iron intakes in men were adequate, low haemoglobin levels were found in 11% of men overall and 37% in the 85+ group. Comparable figures for women were 9% and 16%.

95) Low zinc intakes were found in 8% of men and 5% of women overall, increasing to 15% of men and 10% of women in the oldest group. Low calcium intakes were found in 9% of women overall and 15% of the oldest group.

96) The institution group also had a high proportion with intakes below the LRNI for magnesium and potassium and to a lesser extent for zinc. Iron intake in the institution group was similar to that in the free-living group but the proportion with low iron status was higher. Over half the men and 40% of women in institutions had low haemoglobin levels.

Children and young people 1½-18 years

Vitamins (Tables 19, 22 & 23)

97) Mean intakes of all vitamins except vitamin A were above RNIs. Mean vitamin A intakes were close to or above the RNI in younger children but below the RNI in older groups. A fifth of 11-14 year old girls and 13% of boys in the same age group had vitamin A intakes below the LRNI, as did 12% of boys and girls aged 15-18. However there was little evidence of low vitamin A status based on plasma retinol levels[20] except in the 1½-4½ year group. The main food sources of vitamin A in 4-18 year olds were vegetables, providing about a quarter of average intake and milk and milk products, providing about a fifth.

98) Intakes were below the LRNI for riboflavin in 6% of boys and a fifth of girls in the 11-18 age groups. Raised levels of EGRAC, indicating marginal riboflavin status, were found in a high proportion of this age group[xv].

99) Mean vitamin D intakes from food for children under 4 years was 18% of the RNI. However there was no evidence of low status in this group. In older children status indices for vitamin D indicate that 13% of 11-18 year-olds had low status (below the normal adult range [25,26]). This proportion increased in the winter months.

100) Although dietary intakes of vitamin B_6 appear to be adequate, raised EAATAC levels[xvi,28] indicating deficiency were found in 10% of the 4-18 year age group. Low levels of serum B_{12}[28] were also found in 8% of 15-18 year old girls although intakes were adequate.

[xv] There are issues with the activation coefficient used to define those subjects who have marginal riboflavin status..

[xvi] Erythrocyte Aspartate Aminotransferase Activation Co-efficient (EAATAC) is a measure of the saturation of a red cell enzyme with a co-factor derived from vitamin B_6.

101)Secondary analysis of the NDNS dataset for 4-18 year-olds[29] found that high consumers (the top third of population) of breakfast cereals had better folate, vitamin B_{12} and riboflavin status; there was also an association with thiamin and vitamin B_6 status in girls. The author found that there was no difference in iron status between groups, possibly due to lower meat intakes in high consumers of cereal.

Minerals (Table 20, 21)

102)Mean intakes of most minerals in young children were above the RNI, with the exception of iron in the under 4s, and zinc. However, in the older groups, mean intakes for a number of minerals were below the RNI: zinc in all groups, potassium, magnesium and calcium in older boys and girls, and iron and copper in older girls. Significant proportions of 11-18 year olds had intakes below the LRNI for potassium, magnesium and zinc, and for older girls, iron, calcium and iodine.

103)Sixteen percent of children under 4 years had iron intakes below the LRNI (data collected in 1992) but intakes below the LRNI in the 4-6 age group were negligible (data collected in 1997). A substantial proportion of both age groups was anaemic and/or had low iron stores. In 11-14 and 15-18 year old girls, 45% and 50% respectively did not meet the LRNI and 14% and 27% had low serum ferritin levels.

104)Further analysis of the data[29] found that 30% of girls aged 11-18 had at least one indicator of low iron status, low haemoglobin, ferritin or transferrin saturation levels. It was found that eating red meat, fruit and fruit juice and salads were positively correlated with iron status while drinking more than one cup of tea a day and the onset of menarche were negatively correlated with iron status.

105)Further analysis of the NDNS 1½-4½ year dataset[30] found that dietary iron intake from food sources was only related to iron status in children with the lowest iron status. The key dietary variables for haemoglobin were vitamin C and copper (positively associated) and polyunsaturated fats (negatively associated). Polyunsaturated fats were also negatively correlated with ferritin levels. Another secondary analysis[26] found that adolescent girls who were non-Caucasian or vegetarian had significantly poorer iron status than Caucasians or meat eaters.

106)Intakes of zinc were low across the age group. Further analysis of the NDNS 4-18 data[32] found that low zinc intakes were consistently more prevalent in children with a poor self-reported variety of foods in the diet and appetite rating. In addition, low intakes were less prevalent in girls aged 11-18 who consumed higher amounts of breakfast cereals.

<u>Overview of micronutrient intakes and status</u>

107)Mean intakes of vitamins were above the RNIs in all age groups except for vitamin A, which fell below the RNI for children and young adults. Vitamin A intakes below the LRNI were found in a substantial proportion of children and adults although there was no evidence of low status based on plasma retinol levels. Intakes below the LRNI were also found for riboflavin in older children, young adults and older people.

108)Mineral intakes were generally lower in relation to the DRVs than vitamin intakes. Intakes of magnesium and potassium were low in all age groups except young children, while a pattern of low intakes of several other minerals including calcium, zinc and iodine was seen in older children and young adults, particularly women.

109) Total iron intakes in girls and women of childbearing age were low compared with the DRVs. Up to 50% of some age groups had intakes below the LRNIs. Status indices (total haemoglobin, percentage iron saturation and serum ferritin) suggest that a smaller proportion of females in the 11-49 age range have a low status than is indicated by the consumption data, although the numbers of both males and females with low status are still significant.

110) The inclusion of dietary supplements increased mean intakes of most vitamins and some minerals, but had little effect on the proportions with intakes below the LRNI, indicating that supplements are generally taken by those who have adequate micronutrient intakes from food.

Table 19: Mean intakes of vitamins from food as a percentage of Reference Nutrient Intake (RNI) and percentage below the Lower Reference Nutrient Intake (LRNI), by age and sex.

Vitamin	Males and females Age (years)		Males aged (years)							
	1½-4		4-6		7-10		11-14		15-18	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Vitamin A (retinol equivalents) (µg)	128	8	114	8	101	9	93	13	88	12
Thiamin (mg)	154	0	181	-	202	-	189	0	173	-
Riboflavin (mg)	197	0	194	-	162	1	144	6	148	6
Niacin equivalents (mg)	197	-	207	-	216	0	200	0	203	-
Vitamin B_6 (mg)	170	1	189	-	194	-	182	1	180	0
Vitamin B_{12} (µg)	560	-	499	-	395	-	372	0	330	-
Folate (µg)	184	0	191	-	141	-	123	1	152	-
Vitamin C (mg)	160	1	223	-	243	-	218	-	208	-
Vitamin D (µg)†	*18*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Number of subjects (unweighted)	*1457*		*184*		*256*		*237*		*179*	

Vitamin	Females aged (years)							
	4-6		7-10		11-14		15-18	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Vitamin A (retinol equivalents) (µg)	112	6	96	10	78	20	91	12
Thiamin (mg)	163	-	182	-	200	1	172	2
Riboflavin (mg)	175	-	137	1	120	22	118	21
Niacin equivalents (mg)	186	-	195	-	205	-	180	1
Vitamin B_6 (mg)	169	-	174	1	190	1	150	5
Vitamin B_{12} (µg)	446	-	347	1	270	1	225	2
Folate (µg)	169	-	126	2	102	3	105	4
Vitamin C (mg)	217	0	245	-	202	1	185	0
Vitamin D (µg) †	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Number of subjects (unweighted)	*171*		*226*		*238*		*210*	

† Vitamin D is also obtained from the action of sunlight on the skin. There are no DRVs specified for vitamin D intake for children aged 4 years and over.

Table 19 (continued) Mean intakes of vitamins from food as a percentage of Reference Nutrient Intake (RNI) and percentage below the Lower Reference Nutrient Intake (LRNI), by age and sex.

Vitamin	Males aged (years)							
	19-24		25-34		35-49		50-64	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Vitamin A (retinol equivalents) (μg)	80	16	103	7	141	5	164	4
Thiamin (mg)	160	2	232	0	204	0	230	1
Riboflavin (mg)	129	8	163	1	168	2	169	3
Niacin equivalents (mg)	232	-	272	-	270	0	279	0
Vitamin B_6 (mg)	189	-	211	0	206	2	201	1
Vitamin B_{12} (μg)	296	1	395	-	465	0	485	0
Folate (μg)	151	2	173	-	171	0	181	-
Vitamin C (mg)	162	-	185	0	221	-	236	-
Vitamin D (μg)[†]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of subjects (unweighted)	*61*		*160*		*303*		*242*	
Vitamin	**Females aged (years)**							
	19-24		**25-34**		**35-49**		**50-64**	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Vitamin A (retinol equivalents) (μg)	78	19	98	11	112	8	136	5
Thiamin (mg)	181	-	194	2	190	1	200	1
Riboflavin (mg)	126	15	131	10	151	5	159	6
Niacin equivalents (mg)	246	2	240	-	263	1	270	0
Vitamin B_6 (mg)	165	5	158	1	170	2	177	2
Vitamin B_{12} (μg)	266	1	264	1	325	1	378	0
Folate (μg)	114	3	117	2	128	2	134	2
Vitamin C (mg)	170	1	181	-	200	0	236	0
Vitamin D (μg)[†]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of subjects (unweighted)	*78*		*211*		*379*		*290*	

[†] Vitamin D is also obtained from the action of sunlight on the skin. No DRV is set for adults.

Table 19 (continued) Mean intakes of vitamins from food as a percentage of Reference Nutrient Intake (RNI) and percentage below the Lower Reference Nutrient Intake (LRNI), by age and sex.

Vitamin	**Males aged (years)**									
	65-74 *Free-living*		**75-84 *Free-living***		**85+ *Free-living***		**65-84 *Institution***		**85+ *Institution***	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Vitamin A (retinol equivalents) (μg)	173	4	160	6	149	2	147	1	157	-
Thiamin (mg)	170	-	179	1	174	1	n/a	1	168	1
Riboflavin (mg)	137	4	130	5	126	5	133	3	146	2
Niacin equivalents (mg)	208	-	215	1	199	0	N/A	-	194	0
Vitamin B_6 (mg)	169	2	167	1	150	3	N/A	1-2	150	1
Vitamin B_{12} (μg)	427	-	367	1	320	-	327	-	333	-
Folate (μg)	141	0	125	1	117	4	117	4	118	5
Vitamin C (mg)	179	1	148	3	127	2	123	-	127	2
Vitamin D (μg)[†]	43	N/A	38	N/A	32	N/A	36	N/A	41	N/A
Number of subjects (unweighted)	*271*		*265*		*96*		*128*		*76*	
Vitamin	**Females aged (years)**									
	65-74 *Free-living*		**75-84 *Free-living***		**85+ *Free-living***		**65-84 *Institution***		**85+ *Institution***	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Vitamin A (retinol equivalents) (μg)	161	4	165	5	152	4	156	1	164	-
Thiamin (mg)	153	-	166	-	157	1	n/a	-	153	0
Riboflavin (mg)	133	10	128	9	117	15	155	-	141	6
Niacin equivalents (mg)	214	-	200	-	183	1	207	-	184	0
Vitamin B_6 (mg)	170	2	150	2	140	6	170	-	150	0
Vitamin B_{12} (μg)	307	1	300	1	233	4	300	-	307	-
Folate (μg)	108	4	101	7	92	11	105	2	94	8
Vitamin C (mg)	168	1	136	1	122	4	129	-	111	0
Vitamin D (μg)[†]	30	N/A	30	N/A	23	N/A	33	N/A	33	N/A
Number of subjects (unweighted)	*256*		*217*		*170*		*91*		*117*	

[†] Vitamin D is also obtained from the action of sunlight on the skin.

Table 20: Mean intakes of minerals from food sources as a percentage of Reference Nutrient Intake (RNI) and percentage with intakes below the Lower Reference Nutrient Intake (LRNI), by age and sex.

Mineral	Males and females aged (years)		Males aged (years)							
	1½- 4		4-6		7-10		11-14		15-18	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Total iron (mg)	77	16	134	-	111	1	95	3	111	2
Calcium (mg)	183	1	157	3	135	2	80	12	88	9
Magnesium (mg)	159	0	143	3	97	2	78	28	85	18
Potassium (mg)	187	0	177	-	107	-	77	10	81	15
Zinc (mg)	87	14	85	12	88	5	79	14	92	9
Iodine (µg)	170	3	156	2	140	1	124	3	139	1
Copper (mg)**	119	N/A	117	N/A	116	N/A	112	N/A	106	N/A
Number of subjects (unweighted)	*1457*		*184*		*256*		*237*		*179*	

Mineral	Females aged (years)							
	4-6		7-10		11-14		15-18	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Total iron (mg)	119	1	96	3	60	45	58	50
Calcium (mg)	146	2	119	5	80	24	82	19
Magnesium (mg)	129	1	89	5	65	51	64	53
Potassium (mg)	161	-	101	1	68	19	62	38
Zinc (mg)	75	26	81	10	66	37	87	10
Iodine (µg)	143	2	119	3	92	13	96	10
Copper (mg)**	106	N/A	105	N/A	98	N/A	80	N/A
Number of subjects (unweighted)	*171*		*226*		*238*		*210*	

** no LRNI set for copper

Table 20 (continued): Mean intakes of minerals from food sources as a percentage of Reference Nutrient Intake (RNI) and percentage with intakes below the Lower Reference Nutrient Intake (LRNI), by age and sex.

Mineral	Males aged (years)							
	19-24		25-34		35-49		50-64	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Total iron (mg)	131	3	150	0	157	1	156	1
Calcium (mg)	123	5	145	2	149	2	147	2
Magnesium (mg)	86	17	103	9	106	7	106	9
Potassium (mg)	81	18	94	3	99	5	101	5
Zinc (mg)	95	7	108	2	111	4	109	3
Iodine (μg)	119	2	154	1	158	2	164	1
Copper (mg)**	95	N/A	114	N/A	128	N/A	126	N/A
Number of subjects (unweighted)	*61*		*160*		*303*		*242*	

Mineral	Females aged (years)							
	19-24		25-34		35-49		50-64	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Total iron (mg)	60	42	62	41	69	27	122	4
Calcium (mg)	99	8	104	6	114	6	118	3
Magnesium (mg)	76	22	77	20	87	10	91	7
Potassium (mg)	67	30	68	30	78	16	82	10
Zinc (mg)	98	5	96	5	108	4	112	3
Iodine (μg)	93	12	103	5	116	4	127	1
Copper (mg)**	76	N/A	83	N/A	88	N/A	89	N/A
Number of subjects (unweighted)	*78*		*211*		*379*		*290*	

** no LRNI set for copper

Table 20 (continued): Mean intakes of minerals from food sources as a percentage of Reference Nutrient Intake (RNI) and percentage with intakes below the Lower Reference Nutrient Intake (LRNI), by age and sex.

Mineral	Males aged (years)									
	65-74 *Free-living*		**75-84 *Free-living***		**85+ *Free-living***		**65-84 *Institution***		**85+ *Institution***	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Total iron (mg)	128	-	124	2	120	4	110	4	110	5
Calcium (mg)	122	4	116	5	109	2	134	-	140	1
Magnesium (mg)	88	16	80	29	72	36	71	37	72	42
Potassium (mg)	81	14	72	23	66	34	70	27	69	28
Zinc (mg)	95	6	88	12	85	15	88	14	87	12
Iodine (μg)	137	1	129	2	119	4	139	1	137	2
Copper (mg)**	98	N/A	87	N/A	73	N/A	80	N/A	77	N/A
Number of subjects (unweighted)	*271*		*265*		*96*		*128*		*76*	

Mineral	Females aged (years)									
	65-74 *Free-living*		**75-84 *Free-living***		**85+ *Free-living***		**65-84 *Institution***		**85+ *Institution***	
	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI	Mean intake as % RNI	% below LRNI
Total iron (mg)	103	4	97	6	89	10	99	4	90	8
Calcium (mg)	101	8	97	10	92	15	129	1	118	1
Magnesium (mg)	77	19	69	27	66	34	74	16	66	27
Potassium (mg)	66	30	60	47	56	57	65	33	58	50
Zinc (mg)	100	3	96	7	91	10	107	1	96	6
Iodine (μg)	109	6	103	4	102	7	129	1	121	1
Copper (mg)**	76	N/A	69	N/A	66	N/A	72	N/A	68	N/A
Number of subjects (unweighted)	*256*		*217*		*170*		*91*		*117*	

** no LRNI set for copper

Table 21: Percentage of respondents below thresholds for iron status

Gender and age	Haemoglobin concentration	% Iron saturation	Serum ferritin	*Number of subjects (unweighted)*
	lower threshold for anaemia	lower threshold for anaemia	low iron stores	
	%	%	%	
Male aged (years)				
1.5-4.5	7	n/a	24	*475/ - /467*
4-6	3	23	18[†]	*86/60/69*
7-10	47	18	14	*185/150/147*
11-14	30	19	17	*181/166/153*
15-18	1	12	5	*164/149/131*
19 – 24	-	6	4	*45/45/45*
25 – 34	2	13	0	*119/115/119*
35 – 49	4	3	6	*245/243/245*
50 – 64	3	6	5	*210/206/210*
65+ Free-living	11	6	7	*495/467/477*
65+ Living in an institution	52	21	11	*147/134/141*
Female aged (years)				
1.5-4.5	9	n/a	17	*476/ - /463*
4-6	8	24	9[††]	*82/61/63*
7-10	16	18	2	*143/119/99*
11-14	4	20	14	*171/155/128*
15-18	9	30	27	*169/159/136*
19 – 24	7	27	16	*53/47/53*
25 – 34	8	17	8	*157/154/157*
35 – 49	10	18	12	*298/296/298*
50 – 64	7	8	8	*210/206/210*
65+ Free-living	9	15	9	*474/446/451*
65+ Living in an institution	39	30	10	*135/119/122*

[†] percent less than 20µg/l; [††] percent less than 15 µg/l

Thresholds

Haemoglobin (g/dl)[26]: 1½-6 years (male & female) <11.0
7 years + male <13.0
7 years + female <12.0

Iron saturation %[19]: 4 years + (male & female) < 15

Serum ferritin (µg/l)[27] 1½-4½ years (male & female) <10
7 years + male < 20
7 years + female < 15

Table 22: Percentage of respondents with low status for water soluble vitamins

	Plasma vitamin C [24]	Red cell folate [23]		Serum folate[24]	Serum vitamin B_{12}[25]	Thiamin (ETKAC)[20]	Riboflavin (EGRAC)[22]	Vitamin B_6 (EAATAC)[28]	*Number of subjects (unweighted)*
	Biochemical depletion (< 11µmol/l)	severely deficient (<230nmol/l)	marginal status (230-350 µmol/l)	Deficient (< 6.3 nmol/l)	Lower limit of normal range (< 118 pmol/l)	Biochemical deficiency (>1.25)	Marginal /deficient status (>1.3)	biochemical deficiency (> 2.0)	
	%	%	%	%	%	%	%	%	
Males aged (years)									
1.5-4.5	3**	n/d	n/d	n/d	n/d	n/a	19	n/a	*380-421*
4-6	5	-	3	-	-	1	59	7	*69-86*
7-10	2	1	3	-	-	-	78	8	*165-185*
11 – 14	1	1	7	-	-	0	80	11	*172-181*
15 –18	3	-	12	1	1	-	80	15	*152-161*
19 – 24	7	-	13	-	-	-	82	4	*45*
25 – 34	5	1	3	1	-	3	70	10	*119*
35 – 49	4	1	4	1	2	2	67	13	*245*
50 – 64	5	-	2	1	3	5	54	11	*191*
65+ Free-living	14	8	20†	16***	8	8	41	n/a	*454-480*
65+ Living in an institution	44	13	29†	40***	7	11	41	n/a	*132-142*
Females aged (years)									
1.5-4.5	2**	n/d	n/d	n/d	n/d	n/a	27	n/a	*364-407*
4-6	2	-	1	-	-	1	75	6	*76-82*
7-10	3	1	8	-	-	2	85	11	*125-138*
11 – 14	1	-	11	1	-	2	90	14	*161-169*
15 – 18	4	1	13	1	8	3	95	8	*156-169*
19 – 24	4	-	8	-	5	-	77	12	*53*
25-34	3	-	4	-	5	1	78	8	*157*
35 – 49	4	-	5	0	4	2	69	12	*298*
50 – 64	3	0	6	-	3	1	50	13	*210*
65+ Free-living	13	8	22†	14***	5	9	42	n/a	*439-459*
65+ Living in an institution	38	18	15†	38***	10	15	32	n/a	*116-122*

; ** Less than 10µmol/l; *** Less than 7nmol/l; † 230-345µmol/l

Table 23: Percentage of respondents with low status for fat soluble vitamins

	Plasma retinol [16]		Plasma 25-hydroxyvitamin D[25]	Tocopherol: cholesterol ratio[12]	*Number of subjects (unweighted)*
	severely deficient (<0.35µmol/l) %	marginal status (0.35-0.7 µmol/l) %	below lower limit of normal range (<25 nmol/l) %	below lower limit of normal range (< 2.25) %	
Males aged (years)					
1.5-4.5	2*	11**	-	n/a	*377-411*
4-6	-	2	3	-	*55-73*
7-10	-	2	4	-	*135-167*
11 – 14	-	-	11	-	*163-177*
15 –18	-	-	16	-	*143-153*
19 – 24	-	-	24	1	*45*
25 – 34	-	-	16	1	*107-115*
35 – 49	-	-	12	1	*213-243*
50 – 64	-	1	9	1	*168-189*
65+ Free-living	-	-	6	n/d	*436-476*
65+ Living in an institution	-	3	38	n/d	*131-138*
Females aged (years)					
1.5-4.5	2*	10**	1	n/a	*360-405*
4-6	-	3	2	-	*49-76*
7-10	-	2	7	-	*108-133*
11 – 14	-	-	11	-	*145-164*
15 –18	-	0	10	-	*155-162*
19 – 24	-	-	28	-	*44-47*
25 – 34	-	-	13	2	*146-154*
35 – 49	-	-	15	1	*278-296*
50 – 64	-	-	11	3	*191-206*
65+ Free-living	-	0	10	n/d	*416-451*
65+ Living in an institution	-	-	37	n/d	*113-120*

* < 0.5 µmol/l
** 0.5 - 0.75 µmol/l

Salt *(Table 24; Figure 6)*

111)Sodium intakes are estimated from 24-hour urine collections as estimates based on dietary records exclude salt added at the table or in cooking and so underestimate actual intake. Sodium intakes based on 24-hour urine collections are available from the 1986/87 and 2000/01 surveys of adults. Average intakes of salt in 2000/01 were 9.5g/day overall (11g/day for men and 8g/day for women); well above 6g/day (the recommended maximum).

Figure 6a: Mean salt intakes in men in 1986/87 and 2000/01

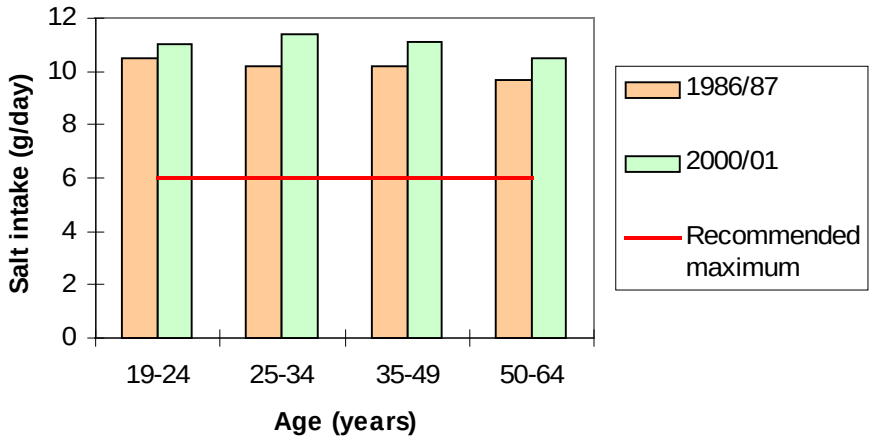
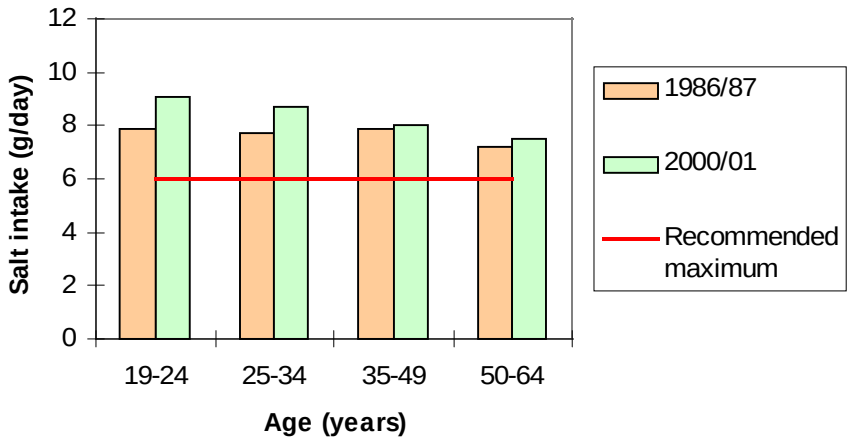


Figure 6b: Mean salt intakes in women in 1986/87 and 2000/01



112)The proportions of the population consuming less than 6g/day in 2000/01 were 15% of men and 31% of women. Men and women in the 19-24 age group were least likely to meet the target with only 2% and 17% consuming less than 6g/day, respectively. At the upper end of the distribution, 21% of men and 5% of women had an intake above 15g/day.

113)The average intake of salt has increased from 9g/day in 1986/87 to 9.5g/day in 2000/01.

114) It is estimated that 75% of salt intake comes from processed foods. Of the remainder 10-15% comes from naturally occurring sodium in foods and 10-15% from discretionary salt added to food at the table or in cooking.

Table 24: Percentage distribution of salt intake (g/day) estimated from total urinary sodium

Salt intake (g/day)	Men aged (years)				All men	Women aged (years)				All women
	19-24	25-34	35-49	50-64		19-24	25-34	35-49	50-64	
	cum %	Cum %	cum %	cum %	cum %	cum %	cum %	cum %	cum %	cum %
3 or less	-	5	2	5	4	4	6	5	7	6
6 or less	2	20	13	18	15	17	29	31	38	31
9 or less	37	34	39	42	39	66	59	68	69	66
12 or less	60	57	58	65	60	84	81	85	91	86
15 or less	81	73	80	83	79	90	92	96	96	95
18 or less	100	89	91	91	91	92	97	100	99	98
All		100	100	100	100	100	100		100	100
Mean	11.0	11.4	11.1	10.5	11.0	9.1	8.7	8.0	7.5	8.1
Number of subjects (unweighted)	*31*	*103*	*221*	*183*	*538*	*44*	*131*	*244*	*204*	*623*

Oral health

Adults 19-64 years

115)The dental status of adults was assessed in the 2000/01 NDNS[34,35]. Overall 5% of this age group were edentulous (no natural teeth) and a further 10% had between one and 20 teeth. Rates of edentulousness increased with age and number of teeth was associated with reported difficulty eating hard-to-chew foods. In the oldest age group (45-64 years) median fruit and vegetable intake was 290g/day in the dentate compared to 208g/day in the edentate.

Older adults aged 65 years and over

116)The NDNS of people aged 65 years and over included analysis of associations between oral health (in particular the presence of natural teeth) and diet and nutritional status[36]. The survey found that better oral health, including how many natural teeth people had, was associated with better nutritional status. The condition of the mouth and the presence, number and distribution of natural teeth was related to the ease and ability to eat foods such as fresh fruit and uncooked vegetables and foods requiring more chewing. In the free-living group edentate respondents reported greater difficulty with eating a range of foods, for example apples, than did the dentate group. Ease of eating a range of foods was related to the number of natural teeth present and in particular the number of pairs of opposing teeth. The free-living edentate group had a lower mean energy intake than the dentate group (ns) and lower intakes of protein, NSP, iron, calcium, niacin equivalents and vitamin C. This group also had lower status levels for vitamins A, C and E.

117)Prevalence of poor oral health (particularly poor oral hygiene and root decay) was higher in the institution group than in the free-living group. There were few subjects with natural teeth in the institution group. Over half the group reported difficulty with eating foods such as nuts and raw carrots. There were fewer differences in nutrient intakes and nutritional status between the dentate and edentate groups than there were in the free-living group. The median plasma vitamin C level in the edentate group in institutions was 11.4µmol/l, close to the threshold for biochemical depletion (11µmol/l).

Children and young people aged 1½-18 years

118)The oral health component of the NDNS of children aged 1½-4½ years, carried out in 1992/93[37], found that 17% of children in this age group had some experience of dental decay, increasing to 30% in the 3½-4½ year age group. Children in Scotland and the North of England had more decay than children in other parts of England and Wales. Half the 3½-4½ year age group in Scotland and 43% in Northern England had some experience of dental decay, compared with less than a quarter of children in the rest of England and Wales. Having a drink in bed every night was associated with increased decay experience in the 1½-2½ year and 2½-3½ year age groups. The frequency of consumption of sugar confectionery and carbonated drinks was related to dental decay in all age groups. For example, 40% of 3½-4½ year olds who had sugar confectionery most days or more often had experience of caries compared with just over a fifth of less frequent consumers of sugar confectionery.

119)An identical survey carried out as part of the 1997 NDNS of young people 4-18 years[38] found that the proportion with dental decay increased from 37% in the 4-6 year group to 67% in the 15-18 year group. The prevalence of decay was highest in Scotland and

lowest in London and the South East. Like the pre-school children there were links between the frequency of consumption of sugary foods and dental decay, but no significant associations were observed between the quantities of sugary foods consumed and dental caries.

Regional differences in diet and nutritional status

120) Generally the surveys show few clear regional trends or patterns in diet, nutrient intake or nutritional status. This is partly because the sample size in each region was sometimes too small for differences to reach statistical significance, particularly for Scotland.

121) There is some evidence of lower fruit and vegetable consumption in Scotland (and to a lesser extent Northern England) but this is not consistent across surveys. Children in Scotland were less likely to eat most types of vegetables (but not fruit) than children in other regions and older people (65 and over) in Scotland and the North were less likely to eat most types of fruit than those in other regions. The most recent survey of adults (2000/01) found no regional differences in consumption of fruit and vegetables overall, although women in Scotland and in the North ate fewer vegetables than women in London and the South East.

122) There were very few regional differences in intake of energy and macronutrients. Children and older people in Scotland had lower NSP intakes than other regions, probably reflecting low fruit and vegetable consumption. There was no regional difference in NSP intake in the most recent adults survey.

123) Regional differences in micronutrient intakes and status were more marked than those for macronutrients. Young children (1½-4½ years) in Scotland had the lowest mean intakes of vitamin C and total carotene and the lowest intakes of some minerals. However mean intakes of folate in this age group were lowest in London and the South East and Northern England. Further analysis of this dataset[30] found that higher proportions of children with combined low intakes of vitamin A, iron and zinc (7-9% compared to 2% overall) were found in parts of the North and in Scotland. Children in the North also had lower mean blood levels of water-soluble vitamins, e.g. vitamin C, than those in other regions, but the differences were not statistically significant. In the later survey of the 4-18 year group the differences were less marked. Children in Scotland had lower mean intakes of some vitamins compared to some other regions but there were few consistent patterns. Girls in the North had lower mean plasma vitamin C levels than those in other regions.

124) In the most recent survey of adults 19-64 years, there were very few regional differences in micronutrient intakes or status. There was some evidence of higher mean intakes in London and the South East than elsewhere for some vitamins, e.g. vitamin C for men, but there were no differences for minerals. There was also some evidence of lower blood levels of water soluble vitamins in Scotland compared with other regions, e.g. plasma vitamin C in men, serum folate in women. There were no significant regional differences in plasma 25-hydroxy vitamin D levels for men or women although the data suggest that mean levels tended to be lowest in Scotland and highest in the North. In the survey of older adults aged 65 years and over, mean plasma vitamin D levels were also lower among free-living men and women in Scotland and the North compared with other regions. Intakes of vitamin D, however, showed no significant

regional variations, suggesting the difference in status was due to variation in sunlight exposure.

Socio-economic differences in diet and nutritional status

125)Comparisons of diets, nutrient intakes and nutritional status in people from lower and higher socio-economic status households (based on household receipt of benefits, social class and household income) show clear differences. People from lower socio-economic status households have different dietary patterns, in particular lower consumption of fruit and vegetables and also have lower intakes and blood levels of many micronutrients. Unless otherwise stated, differences refer to mean levels and a lower mean intake or blood level does not necessarily imply deficiency.

126)The 2000/01 survey of adults showed some marked differences in dietary patterns between adults in benefit households[xvii] and others. The benefit group had a much lower consumption of fruit and vegetables than the non-benefit group (2.1 portions a day for men and 1.9 for women in the benefit group compared with 2.8 portions a day for men and 3.1 for women in the non-benefit group). Those in benefit households were also less likely to eat high fibre breakfast cereals, oily fish and softgrain and other bread and were more likely to eat table sugar (men and women), whole milk, burgers and kebabs and meat pies (women only).

127)Findings in other age groups were similar. Young children (1½-4½ years) in manual social class households were half as likely to consume fruit juice than were their counterparts in non-manual households and were also less likely to eat fruit and salad vegetables, while the manual social class group were more likely to drink tea. Children aged 4-18 years from less advantaged households ate a smaller range of foods and were less likely to consume salad vegetables, fruit, some types of fruit juice and semi-skimmed milk.

128)Mean energy intakes are lower in lower socio-economic groups compared with other groups and so mean intakes of some macronutrients are also lower. Intakes of protein and NSP in particular tend to be lower in people from lower socio-economic households. There are few differences in the proportion of energy derived from the macronutrients. In the 2000/01 adults survey women in benefit households derived a higher proportion of energy intake from NMES and a lower proportion from protein than those in non-benefit households. Findings in other age groups are similar.

129)Adults living in households in receipt of benefits had lower average intake of many vitamins and minerals, compared with adults in non-benefit households. More than half (53%) of women aged 19 to 50 years living in benefit households had an iron intake from food sources below the LRNI, compared with about a third (29%) of those in non-benefit households. People living in households in receipt of benefits had lower status of some micronutrients on average, than people in non-benefit households, specifically vitamin C, folate, vitamin E and selenium for men and women and carotenoids and vitamin D for women.

130)Lower intakes of most vitamins were recorded for young children (1½-4½ years) from manual home backgrounds. When the intakes were adjusted for differences between the

[xvii] Benefit households are those households where one or more members were receiving Working Families Tax Credit at the time of the survey or had drawn Income Support or (income-related) job-seekers allowance in the previous 14 days.

groups in energy intake, the diets of children from manual backgrounds were found to have proportionately lower intakes of total carotene, niacin, vitamin B_{12}, vitamin C and E. Children from non-manual home backgrounds tended to have higher average intakes of most minerals, but after adjusting for energy intakes only intakes of iron, calcium, phosphorous and potassium were significantly higher. The exceptions were sodium and chloride for which higher average intakes were recorded in the diets of children from manual home backgrounds, but the differences were not significant.

131)A further analysis project showed that low intakes of vitamin A, iron and zinc were associated consistently with lower socio-economic status in the 1½-4½ age group[25].

132)Older people in manual social class households also had lower mean intakes of vitamins and minerals and lower blood levels than those from non-manual households.

Low income diet and nutrition survey

133)The Food Standards Agency commissioned a Low Income Diet and Nutrition survey to provide, for the first time, a single robust, representative, baseline dataset on food consumption, nutrient intake and nutritional status and factors affecting these in low-income/materially deprived consumers. The results of the survey will help to understand and address barriers to the uptake of a healthy balanced diet by low-income groups. Fieldwork took place between November 2003 and March 2005. Over 3,600 people, both adults and children took part, throughout the UK. Results are due to be published later in 2007.

Ethnicity

134)No information is available from the NDNS on diet and nutritional status in ethnic minority groups. The NDNS surveys are designed to be nationally representative and the sample sizes are not large enough to permit separate analysis of ethnic minority groups.

Summary and conclusions

135)The availability of data from the NDNS programme, in the form of a series of cross-sectional datasets on discrete population age groups, has enabled this comprehensive assessment to be made of the nutritional health of the British population. In particular the availability of two data points for adults from 1986/87 and 2000/01 has enabled changes in dietary habits and nutritional health to be assessed in this age group. The rolling programme structure planned for future NDNS will provide more frequent data points on each age group allowing a better assessment of trends in dietary behaviour.

136)The findings presented in this paper show a mixed picture of the diet and nutritional health of the population. While there is some evidence of positive dietary changes, especially the fall in fat and saturated fat intakes over the last fifteen years, there are a number of areas of concern, particularly for older children, young adults and people in lower socioeconomic groups. These groups tend to consume unbalanced diets with low consumption of fruit and vegetables in particular and show evidence of low intakes and status for a number of vitamins and minerals. This gives rise to concerns about the implications for the long term health of these groups.

137)Mean consumption of fruit and vegetables was below the five-a-day recommendation for adults in all age groups and was lowest in children, young adults and people in

benefit households. Fruit and vegetable consumption was higher in 2000/01 than in 1986/87 for the 19-64 age group as a whole, the difference attributable to higher consumption in the older age groups. Consumption in the 19-24 age group was not higher in 2000/01. Oily fish consumption was below the recommendation of 1 portion a week in all age groups and was just over a third of a portion per week for adults. Soft drink consumption was substantially higher compared with the mid-1980s. Mean consumption in adults was 1.5 litres per week, while in children mean consumption was 2.8 litres per week in the 1½-4½ age group and over 3 litres per week in the 7-10 age group. Meat consumption was slightly higher in men in 2000/01 compared to 1986/87 but the major contributor had changed from beef to chicken and turkey.

138) Data from the most recent survey of adults (2000/01) shows a lower proportion of energy derived from fat and saturated fat and a higher proportion from total carbohydrate and protein than in the 1986/87 survey.

139) Mean intakes of total fat were generally close to the DRV in all population groups while intakes of saturated fat exceeded the DRV in all groups. The fall in total and saturated fat intakes is also reflected in the fall in plasma total cholesterol and LDL cholesterol levels between 1986/87 and 2000/01. This demonstrates the positive effect of dietary changes reducing fat and saturated fat intake leading to beneficial effects on blood lipid profile and reduction in cardio-vascular disease risk.

140) Mean intakes of non-milk extrinsic sugars exceeded the DRV for most population groups and were particularly high in children and young adults (mainly from soft drinks) and elderly people living in institutions (mainly from table sugar).

141) Alcohol made a significant contribution to energy intake in some consumers and a substantial proportion of adults exceeded the sensible drinking recommendations.

142) Non-starch polysaccharide intakes were low in all age groups.

143) Girls aged 11 upwards and young women and teenage boys and young men, particularly those aged under 25, are more likely than other groups to have low intakes of vitamins and minerals, including vitamin A, riboflavin, iron, potassium and magnesium. This is likely to be at least partly due to lack of variety in the diet, including low consumption of fruit and vegetables and high intakes of sugar and alcohol leading to diets of low nutrient density. There was also evidence of low status in the 15-18 age group for folate and in girls for vitamin B_{12}.

144) Low intakes of some vitamins and minerals were seen in older adults aged over 65, both the free-living and institution groups. There was evidence of low status for some B vitamins, vitamin C and folate, iron and zinc, particularly in the institution group. Diet and nutritional status was clearly associated with oral health in this age group, in particular the number of natural teeth.

145) Evidence of low vitamin D status was found in most population age groups especially in a proportion of older children and young adults, and in elderly people living in institutions.

146) Low iron intakes were found in young children (under 5 years), in some teenage girls and young women and in older adults, particularly those living in institutions. Evidence of low iron status was also seen in these groups.

147) The data showed marked differences in diet and nutritional status associated with socio-economic status. Fruit and vegetable consumption was lower in those in benefit households and those from manual social class groups. Both adults and children living in benefit households were more likely to have low intakes (below LRNI) of vitamins and minerals and there was some evidence of lower micronutrient status in this group. Poor oral health, which is associated with low socio-economic status, is a risk factor for poor diet and nutritional status.

148) Few regional differences were seen in diet or nutritional status. There is evidence from the surveys of some age groups for lower consumption of fruit and vegetables and lower intakes and status of some micronutrients in Scotland and Northern England than elsewhere. However these differences were inconsistent and were not found in the most recent survey of adults.

Recommendation

149) The findings above indicate that action is needed to improve the overall diet of the population in order to reduce the risk of nutrition-related disease. This could be achieved by improvements to the balance of foods in the diet. It is recommended that high priority continues to be given to work in this area, specifically to promote increased consumption of fruit and vegetables and fish (especially oily fish), to limit consumption of high fat / high sugar foods such as soft drinks, crisps and confectionery and to reduce salt intakes. This work needs to focus in particular on children, young adults and lower socio-economic groups. There is also a need to improve the quality of the diet for older people living in institutions as the nutritional status of this group is particularly poor.

References

1. Gregory J, Foster K, Tyler H and Wiseman M. *The Dietary and Nutritional Survey of British Adults*. HMSO (London: 1990).
2. Gregory J, Collins DL, Davies PSW, Hughes JM & Clarke PC. *National Diet and Nutrition Survey: Children aged 1½ to 4 ½ years. Volume 1: Report of the diet and nutrition survey.* HMSO (London: 1995).
3. Finch S, Doyle W, Lowe C, Bates CJ, Prentice A, Smithers G & Clarke PC. *National Diet and Nutrition Survey: people aged 65 years or over. Volume 1: Report of the diet and nutrition survey.* TSO (London: 1998).
4. Gregory J, Lowe S, Bates CJ, Prentice A, Jackson LV, Smithers G, Wenlock R & Farron M. *National Diet and Nutrition Survey: young people aged 4 to 18 years. Volume 1: Report of the diet and nutrition survey* (2000). TSO (London: 2000).
5. Henderson L, Gregory J, & Swan G. *National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 1: Types and quantities of foods consumed*. TSO (London: 2002).
6. Henderson L, Gregory J, Irving K & Swan G. *National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 2: Energy, protein, carbohydrate, fat and alcohol intake*. TSO (London: 2003).
7. Henderson L, Irving K, Gregory J, Bates CJ, Prentice A, Perks J, Swan G & Farron M. *National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 3: Vitamin and mineral intake and urinary analytes*. TSO (London: 2003).
8. Ruston D, Hoare J, Henderson L, Gregory J, Bates CJ, Prentice A, Birch M, Swan G & Farron M. *National Diet and Nutrition Survey: adults aged 19-64 years. Volume 4: Nutritional Status (anthropometry and blood analytes), blood pressure and physical activity.* TSO (London: 2004).
9. Hoare J, Henderson L, Bates CJ, Prentice A, Birch M, Swan G, Farron M. National Diet and Nutrition Survey: adults aged 19-64 years. Volume 5: Summary report. TSO (London: 2004)
10. Livingstone MBE, Prentice AM, Strain JJ, Coward WA, Black AE, Barker ME, et al. Accuracy of weighed dietary records in studies of diet and health. *British Medical Journal* 1990;**300**:708-712.
11. Department of Health. Report on Health and Social Subjects 41. Dietary Reference Values for food energy and nutrients for the United Kingdom. HMSO (London, 1991)
12. Department of Health. Report on Health and Social Subjects 46. Nutritional Aspects of Cardiovascular Disease. HMSO (London, 1994)
13. Scientific Advisory Committee on Nutrition. Salt and Health. TSO (London, 1993)
14. Department of Health. Report on Health and Social Subjects 48. Nutritional Aspects of the Development of Cancer. TSO (London, 1998)
15. Bates CJ, Prentice A, van der Pols JC, Walmsley C, Pentieva KD, Finch S, Smithers G & Clarke PC. Estimation of the use of dietary supplements in the National Diet and Nutrition Survey: people aged 65 years and over. An observed paradox and a recommendation. E J Clin Nutr 1998 52 917-923
16. Zohouri FV, Rugg-Gunn AJ, Fletcher ES, Hackett AF, Moynihan PJ, Mathers JC, Adamson AJ. Changes in water intake of Northumbrian adolescents 1980 to 2000. Br Dental J (2004) 196: 547-552

17. Food Standards Agency. Secondary analysis of NDNS adults 2000/01 for characteristics of high fat, saturated fat and sugar consumers. Unpublished.

18. Expert Panel on detection, evaluation and treatment of high blood cholesterol in adults. Executive summary of the third report of the national cholesterol education program (NCEP) expert panel on detection, evaluation and treatment of high blood cholesterol in adults (Adult treatment panel III). JAMA 2001; 285: p2486-2497

19. Stampfer MJ, Sacks FM, Salvini S, Willett WC, Hennekens CH. A prospective study of cholesterol, apolipoproteins, and the risk of myocardial infarction. N Engl J Med (1991) 325 373-81

20. 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.

21. Harvey LJ, Armah CN, Dainty JR, Foxall RJ, Lewis DJ, Langford NJ, Fairweather-Tait, SJ. Impact of menstrual blood loss and diet on iron deficiency among women in the UK. Br. J. Nutr. (2005) **94** 557-564

22. Glatzle D, Korner WF, Christellar F, Wiss O. Method for the detection of biochemical riboflavin deficiency. Int J. Vit Nutr. Res. (1969) 40: 166-183

23. Sauberlich HE, Skala JH, Dowdy RP. *Laboratory tests for the assessment of nutritional status*. CRC Press (Cleveland, Ohio, 1974).

24. Sauberlich HE, *Vitamin status: methods and findings.* Ann NY Acad Sci (1974) 24: 444-454.

25. Department of Health. Report on Health and Social Subjects 41. Nutrition and bone health with particular reference to calcium and vitamin D. TSO (London,1998).

26. Bates CJ, Carter 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. Osteoporos Internat (2003)

27. World Health Organization. *Nutritional Anaemias*. Technical Report Series: 503. WHO (Geneva, 1972).

28. Dacie JV, Lewis SM. *Practical Haematology.* 9th Edition. Churchill Livingstone (Edinburgh, 2001).

29. Gibson S. Micronutrient intakes, micronutrient status and lipid profiles among young people consuming different amounts of breakfast cereals: further analysis of data from the National Diet and Nutrition Survey of young people aged 4 to 18 years. Public Health Nutrition (2003) 6(8) 815-820

30. Gibson S. How can we identify schoolgirls at risk of low iron status and what dietary advice should we be giving? Report to the Food Standards Agency (2003)

31. Thane C. A Review of the National Diet and Nutrition Survey of Children Aged 1.5 to 4.5 Years, to Examine Intakes and Nutritional Status of Iron, Zinc and Vitamin A. Report to the Ministry of Agriculture, Fisheries and Food (1999)

32. Thane C, Bates CJ, Prentice A. Risk factors for low iron intake and poor iron status in a national sample of British young people aged 4-18 years. Public Health Nutrition (2002) 6 (5) 485-496

33. Thane, C.W., Bates, C.J. and Prentice, A. (2004) 'Zinc and vitamin A intake and status in a national sample of British young people aged 4-18 y.' *European Journal of Clinical*

Nutrition, **58**: 363-375.

34. Dhaliwal JS, Steele J, Walls A. Eating difficulty and dental status in 19-64 year olds. [Abstract] IADR/AADR/CADR 82nd General Session, Hawaii, March 2004. Available online: http://iadr.confex.com/iadr/2004Haiwaii/techprogram/abstract_45678.htm

35. Dhaliwal JS, Walls A, Steele J. Nutrient intake and oral status in a UK adult population. [Abstract] IADR/AADR/CADR 83rd General Session, Baltimore, March 2005. Available online: http://iadr.confex.com/iadr/2005Balt/techprogram/abstract_63282.htm

36. Steele JG, Sheiham A, Marcenes W, Walls AWG. *National Diet and Nutrition Survey: people aged 65 years and over. Volume 2: Report of the oral health survey.* TSO (London, 1998).

37. Hinds K, Gregory JR. *National Diet and Nutrition Survey: children aged 1½ to 4½ years. Volume 2: Report of dental survey.* HMSO (London, 1995).

38. Walker A, Gregory J, Bradnock G, Nunn J, & White D. *National Diet and Nutrition Survey: young people aged 4 to 18 years. Volume 2: Report of the oral health survey.* TSO (London, 2000).

Notes to the tables

Data presented for all surveys except the 1986/87 adults survey and the NDNS children aged 1½-4½ years, have been weighted to compensate for the differential probabilities of selection and non-response.

Numbers of subjects shown in the tables are unweighted

n/d cut-off not defined
n/a data not available
'-' = no cases
'0' = less than 0.5

Glossary

Lower Reference Nutrient Intake (LRNI)	The intake of a nutrient which is likely to meet the needs of 2.5% of the population.
Estimated Average Requirement (EAR)	The intake which is likely to meet the needs of 50% of the population
Reference Nutrient Intake (RNI)	The intake which is considered sufficient to meet the requirements of 97.5% of the population

Abbreviations

BMI	Body mass index
BMR	Basic metabolic rate
COMA	Committee on Medical Aspects of Food Policy
CVD	Cardio-vascular disease
DRV	Dietary Reference Value
EAATAC	Erythrocyte Aspartate Aminotransferase Activation Co-efficient
EAR	Estimated Average Requirement
EGRAC	Erythrocyte Glutathione Reductase Activation Co-efficient
ETKAC	Erythrocyte Transketolase Activation Co-efficient
HDL	High density lipoprotein
LDL	Low density lipoprotein
LRNI	Lower reference nutrient intake
NDNS	National Diet and Nutrition Survey
NMES	Non-milk extrinsic sugars
NS	Not statistically significant
NSP	Non-starch polysaccharide
PAL	Physical activity level
RNI	Reference nutrient intake
RTD	Ready to drink
WHO	World Health Organization