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## Slow pace of dietary change in Scotland: 2001–9

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### Abstract

Monitoring changes in the food and nutrient intake of a nation is important for informing the design and evaluation of policy. Surveys of household food consumption have been carried out annually in the UK since 1940 and, despite some changes over the years 1940–2000, the method used for the Expenditure and Food Survey (Living Costs and Food Survey from 2008) has been fundamentally the same since 2001. Using these surveys an analytical procedure was devised to compare food consumption and nutrient intake in Scotland with the Scottish dietary targets, and monitor change. This method takes into account contributions to composite foods and losses due to food preparation, as well as inedible and edible waste. There were few consistent improvements in consumption of foods or nutrients targeted for change over the period 2001–9. A significant but small increase was seen in mean fruit and vegetable consumption (259 g/d in 2001, 279 g/d in 2009, equating to an increase of less than 3 g/person per year). There was also a significant decrease in the percentage of food energy from SFA (15.5% in 2001, 15.1% in 2009) and from non-milk extrinsic sugars (15.5% in 2001, 14.8% in 2009), concurrent with a reduction in whole milk consumption and soft drink consumption, respectively. These small changes are encouraging, but highlight the time taken for even modest changes in diet to occur. To achieve a significant impact on the health of the present Scottish population, the improvements in diet will need to be greater and more rapid.

**Key words:** Diet monitoring; Scotland; Dietary targets; Food purchase surveys

In order to inform national and international policy on food and health and dietary change, there is a continuing need to collect information about the food and nutrient intake of populations. The National Diet and Nutrition Survey (NDNS)<sup>(1,2)</sup> in the UK and the continuous National Health and Nutrition Examination Survey<sup>(3,4)</sup> in the USA are examples of cross-sectional surveys used to collect such information from individuals. In addition to the NDNS, the UK has a long-standing survey of household food consumption, which has been carried out every year since 1940, first as the National Food Survey (NFS; up to 2000)<sup>(5)</sup>, and subsequently in collaboration with family expenditure monitoring in the form of the Expenditure and Food Survey (EFS; 2001–7) and the Living Costs and Food Survey (LCF; 2008 onwards)<sup>(6)</sup>. These household budget surveys yield a continuous picture of the UK diet (albeit with some amendments to the methodology<sup>(7)</sup>) and offer a unique opportunity to examine dietary changes.

The LCF and its predecessor the EFS are continuous cross-sectional surveys of households in the UK, commissioned jointly by the Office for National Statistics and the Department for Environment and Rural Affairs (Defra). The surveys are designed to collect information about household food and expenditure and provide a valuable source of information about food purchases of the population, which can be translated into estimates of food consumption and nutrient intake. They collect household food purchase and eating out data from every person over 7 years of age in each household over a 14-d period. The surveys are not designed to measure intakes of specific individuals.

The continuous nature of the surveys enables them to be used to assess dietary trends, allow comparison with population dietary goals and targets and assess the impact of food and health policy initiatives. In 1996, Scotland formulated time-dependent dietary targets as part of its Scottish Diet Action Plan (SDAP)<sup>(8)</sup> to improve public health. This followed

**Abbreviations:** Defra, Department for Environment and Rural Affairs; EFS, Expenditure and Food Survey; LCF, Living Costs and Food Survey; NDNS, National Diet and Nutrition Survey; NFS, National Food Survey; NMES, non-milk extrinsic sugars; SDAP, Scottish Diet Action Plan; SDT, Scottish Dietary Targets.

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**Table 1.** Scottish Diet Action Plan – dietary targets\*

<b>Food targets</b>	
Fruit and vegetables	Average intake to double to more than 400 g/d
Bread	Intake to increase by 45% from present daily intake of 106 g, mainly using wholemeal and brown breads
Breakfast cereals	Average intake to double from the present intake of 17 g/d
Fish	White fish consumption to be maintained at current levels Oil-rich fish consumption to double from 44 to 88 g/week
Total complex carbohydrates	Increase average non-sugar carbohydrates intake by 25% from 124 g/d, through increased consumption of fruits and vegetables, bread, breakfast cereals, rice and pasta and through an increase of 25% in potato consumption
<b>Nutrient targets</b>	
Fat	Average intake of total fat to reduce from 40.7% to no more than 35% of food energy Average intake of SFA to reduce from 16.6% to no more than 11% of food energy
Salt	Average intake to reduce from 163 to 100 mmol/d (2.3 g Na, 6 g NaCl)
Sugar	Average intake of NMES in adults not to increase Average intake of NMES in children to reduce by half, i.e. to less than 10% of total energy
Total complex carbohydrates	Increase average non-sugar carbohydrates intake by 25% from 124 g/d, through increased consumption of fruits and vegetables, bread, breakfast cereals, rice and pasta and through an increase of 25% in potato consumption

NMES, non-milk extrinsic sugars.  
\* Source: The Scottish Office<sup>(8)</sup>.

from the recognition of the need to tackle the abundance of diet-related disease in Scotland<sup>(9)</sup>. The Scottish Dietary Targets (SDT; Table 1), which include a mixture of food and nutrient-based targets, were originally set for achievement by 2005. The food targets were largely directed at adult dietary intake, but are actually population targets and positively framed in terms of food groups (e.g. eat more fruit and vegetables, breakfast cereals, fish, etc.) whilst the nutrient targets highlighted reductions in nutrients (e.g. less fats, salt and sugar). The Scottish Executive<sup>(10,11)</sup> extended the period for achievement of the SDT to 2010, stating that there should be a ‘measurable incremental impact in Scotland each year to 2010’. The need to monitor progress towards these targets was only formerly recognised in 2003. Following a review of the existing surveys that may be useful to monitor progress (summarised in Table 2), a Working Group on Monitoring Scottish Dietary Targets<sup>(12)</sup> formally concluded that ‘the Expenditure and Food Survey should be used to monitor progress towards the Scottish Dietary Targets in 2005 and beyond’.

The food and nutrient targets used for monitoring were those described in the SDAP<sup>(8)</sup>, but were also informed by the earlier report on the Scottish Diet<sup>(9)</sup>, which identified additional food group indicators. These foods and drinks were considered indicative of overall diet quality and included cakes, biscuits and pastries; processed meat and sausages; bacon and ham; butter; saturated fat margarines and spreads;

whole milk; sugar and preserves; confectionery; soft drinks; and savoury snacks (see Table 3).

The work reported in the present paper is part of an ongoing project to monitor progress towards achieving the SDT and to evaluate the impact of policy initiatives that aim to improve food and nutrient intakes in Scotland. The aim of the present paper is to present the results obtained from the analysis to monitor progress towards the SDT and overall diet quality in order to review changes in food and nutrient intake over the period 2001–9.

### Materials and methods

The LCF (formerly the EFS) is conducted annually, with the sample being spread over four quarters to account for seasonality. The sample for Great Britain is drawn as a multi-stage stratified random sample with clustering, and a representative sample of the private household population is taken (excluding Scottish offshore islands and the Isles of Scilly). Stratification is based on region, the National Statistics Socio-Economic Classification of the household reference person and car ownership<sup>(13)</sup>. Cluster and stratification variables were used in the analysis along with the household weighting factor, which adjusts for household composition within the population. Whilst only those over 7 years of age are asked to complete a diary – all household purchases are recorded,

**Table 2.** Summary of ability of the four UK surveys to monitor progress towards Scottish dietary targets

	Method	Scottish sample size	Frequency
Expenditure and Food Survey/ Living Costs and Food Survey <sup>(34)</sup>	Food purchase data – can be used to calculate energy and nutrients	500–600 households per annum (1100–1400 individuals)	Reports every year
Scottish Health Survey (SHS or SeHS) <sup>(32,33)</sup>	Simple food inventory – cannot calculate nutrients	2003–8148 adults and 3324 children; rolling survey approximately 6500–7500 adults and 1500 children per annum	2003 and rolling survey from 2008
Health Education Population Survey <sup>(36)</sup>	Dietary questions limited to fruit and vegetables	Approximately 1700 adults	2001–7. Merged with SHS in 2008
National Diet and Nutrition Survey (NDNS) <sup>(1,2,16,31)</sup>	Detailed 7-d weighed intake (2000/01), estimated 4-d diary (2008 to date)	2000/2001 (n 114) 2008–10 (not reported to date)	2000/2001 and then rolling programme from 2008 reporting every 3 years

so the data include all household members from birth to old age. Due to the nature of the data, it is not feasible to provide results for different age groups and there are insufficient data to be able to conduct analysis by differing household types on an annual basis. In 2009 the sample for Great Britain was 5116 households (a response rate of 50% for the eligible sample of 10314) and just over 10% of these households were in Scotland<sup>(13)</sup>.

The EFS/LCF data require considerable complex secondary analysis to group the foods relevant to the SDT (and other foods, drinks and nutrients indicative of diet quality) and calculate statistically meaningful results. The calculation of mean per capita consumption and nutrient intakes, with 95% CI, required a series of factors to be applied to the data. This process is essential if any meaningful comparisons are to be made between years.

Population average intakes of foods and nutrients relating to the SDT (Table 1) and other foods and drinks indicative of diet quality (Table 3) were calculated taking into account accepted definitions of target food groups (e.g. the category fruit and vegetables includes tinned, dried and juiced<sup>(14)</sup>, whereas original estimates of fruit and vegetable consumption were based simply on fresh and frozen varieties). Full details of this process are available elsewhere<sup>(15)</sup>.

*Data preparation*

The EFS/LCF coding frames provide details of household and eaten out food purchases and were obtained from Defra. The codes for foods contributing to each part of each dietary target (or other foods and drinks indicative of diet quality) were selected, categorised accordingly and a revised detailed coding frame was compiled for the analysis.

Conversion factors were applied to food purchases to estimate the actual amount of each food that was consumed. They were calculated for each food code, for household and eating out purchases; for the proportion of fruit, vegetable, bread, meat, etc. in a composite food; for the proportion of food in food grouping; raw to cooked weight (where appropriate); proportion of inedible waste; and estimate of edible waste. For example, for calculating the vegetable contribution of vegetarian dishes, a factor of 0.4 was used, as in the NDNS of adults aged 19–64 years<sup>(16)</sup>. Where no factor was necessary, a factor of 1.0 was applied. Conversion factors were also used

to convert dried or concentrated weights to wet weight (e.g. a factor of 3.71 for dried fruit). Data for these conversion factors were taken from McCance and Widdowson's composition of Foods and its supplements<sup>(17–23)</sup>. Where these data were not available from the aforementioned sources, information was sought from manufacturers' label data or market share data supplied by the Food Standards Agency. These conversion factors were added to the coding frame (available on request) and were applied to food purchases to estimate the actual quantity of each food consumed.

Estimates of waste for the UK population published by the Waste and Resources Action Programme (2008)<sup>(24)</sup> have been mapped by Defra to each of the food codes used in the EFS/LCF. This information was obtained from Defra and used to assign a waste factor to each food code. The waste figures were provided for single and multiple adult households and were linked to the appropriate type of household prior to analysis. The figures published by the Waste and Resources Action Programme only account for edible waste. Inedible waste (i.e. bone) was taken into account when calculating the conversion factor for each food code.

An example of an inclusion in the coding frame for white bread is the bread in a pizza. Thus, the consumption figure for 'pizza' would be multiplied by a conversion factor of 0.57 to account for the average fraction of bread in the pizza and then adjusted by 0.2563 or 0.2900 to account for the proportion of pizza wasted in single adult and multiple adult households, respectively.

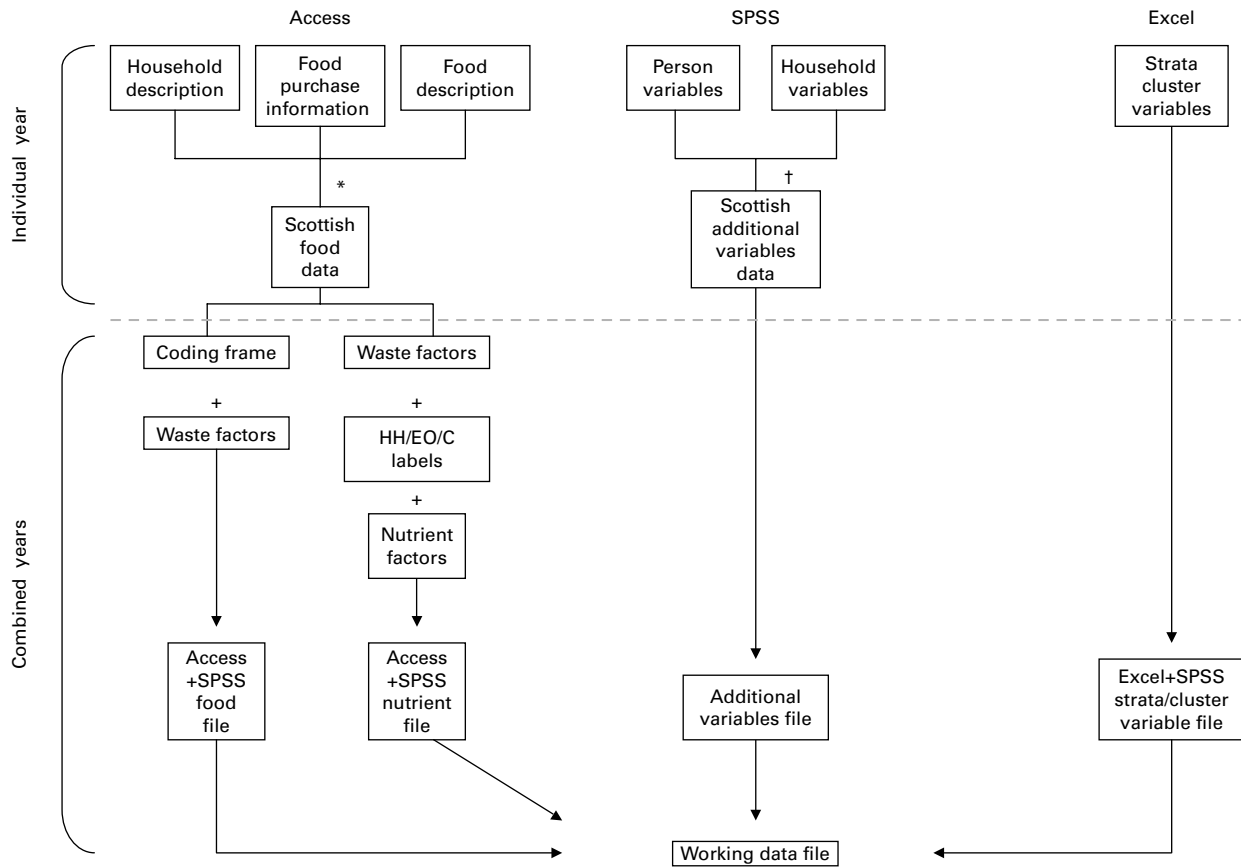
*Data handling*

Primary datasets for each year were obtained from the UK Data Archive, University of Essex. The data comprised three files for each year – a Microsoft Access database containing raw data (at the household level) for food and drink purchases and two SPSS (SPSS, Inc.) files – one containing information on each household and the other containing information on each person within each household. Fig. 1 provides a flow-chart which illustrates the data handling process for data from each year, which were then merged in SPSS to obtain one working data file with the Scottish sample extracted. Data on sampling strata and clusters were obtained from the UK Office of National Statistics.

**Table 3.** Additional dietary recommendations included in the 1993 Scottish Diet report for foods indicative of diet quality\*

Food targets	
Cakes and pastries	Cakes, biscuits and pastry intake to reduce by half
Meat	No further increase in lean meat consumption Processed meat and sausage intake to reduce by half Bacon and ham intake to reduce by 20%
Fats	Butter intake to reduce by two-thirds Replacement of saturated fat margarines and spreads with low saturated fat equivalents
Milk	Whole milk replaced by semi-skimmed except for infants and 1- to 2-year old children
Sugar	Intake of sugar and preserves reduced by half
Confectionery, soft drinks, savoury snacks	Intake cut by one-third for adults and by one-half for children and adolescents

\* Source: The Scottish Office, 1993<sup>(9)</sup>.



**Fig. 1.** Flowchart of data handling process. \*Tables merged and Scottish data selected. †Variables selected, files merged and Scottish data selected. HH, household; EO, eater out; C, household and eater out combined.

The Access database containing the Scottish food purchase data was linked to a table constructed from the coding frame, which listed each food grouping, each food within these groupings and the appropriate conversion factor to be applied to the calculations. This table also contained data on waste for single and multiple adult households. Single and multiple adult households were selected in turn, the appropriate adjustment was then made for waste and the databases re-joined. Household consumption (based on purchases) for each food code was multiplied by the appropriate conversion factor and summed by food grouping. This was then divided by the number of individuals in the household and divided by fourteen to obtain the mean daily consumption per person (or by two in the case of fish to obtain mean weekly consumption per person). For nutrients, household consumption data minus waste (based on purchases) for each food code were multiplied by the appropriate nutrient content per gram (provided by Defra). Household and eaten out nutrient intakes for foods and drinks were then summed for each household. These were then divided by the number of individuals in the household and divided by fourteen to obtain the mean daily intake per person for each nutrient. The food and nutrient data from the Access database were exported to SPSS and merged with the working data file and each household was allocated a new identity number due to overlap in case identity number between years.

### Analysis of data

Due to the multi-staged stratified sampling procedure of the EFS/LCF, data were analysed using Descriptive Statistics and General Linear Models within the Complex Samples module of SPSS, version 18 (SPSS, Inc.). Linear associations between food consumption/nutrient intake and year were assessed by linear regression. The data were weighted (to adjust for non-response and to ensure a match with population totals on household type) so that estimates obtained for mean food consumption and nutrient intake more accurately reflected that of the Scottish population and household composition. These weightings were provided by Defra.

### Presentation of results

Until 2006, the EFS was reported on a financial year basis, i.e. from April of one year to March of the next. From 2006, the EFS moved from a financial year to a calendar year basis. As a consequence of this, the January-to-March 2006 data are duplicated in the 2005/2006 and the 2006 results. For ease of understanding, for years 2001/2002 to 2005/2006 dates have been presented in the text as single years, e.g. 2001/2002 has been presented as 2001, which refers to the period of April 2001 to March 2002.

Food consumption and nutrient intakes (means) relating to the SDT (Tables 4 and 5) and other dietary targets (Tables 6

**Table 4.** Consumption of Scottish Diet Action Plan 1996 target foods by year, 2001–9\*†  
(Mean values and 95% confidence intervals)

Food	Scottish dietary target	2001		2002		2003		2004		2005		2006‡		2007		2008		2009		P for linear association
		Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	
Fruit and vegetables§,	400 g/d	259	241, 278	262	242, 282	247	227, 267	267	244, 290	284	264, 304	276	257, 296	291	267, 315	285	265, 304	279	258, 299	0.012
Fruit§		133	119, 146	136	121, 152	129	115, 143	140	126, 154	153	139, 167	148	136, 160	165	148, 183	154	139, 169	145	131, 158	0.010
Vegetables		126	118, 135	126	118, 134	118	109, 127	127	116, 137	131	122, 140	128	117, 139	125	115, 136	131	121, 141	134	122, 146	0.121
Total bread	154 g/d	111	106, 117	109	104, 113	102	95.7, 109	100	95.1, 105	100	94.6, 106	102	96.1, 108	97.9	93.0, 103	92.9	89.0, 96.9	94.7	90.0, 100	<0.001
Brown/wholemeal bread		18.2	16.3, 20.1	18.9	16.5, 21.4	17.0	14.9, 19.0	22.4	19.9, 24.8	22.2	19.5, 24.9	23.6	20.9, 26.3	23.5	20.5, 26.4	23.6	20.8, 26.4	21.4	19.7, 23.2	<0.001
Total breakfast cereal	34 g/d	19.6	17.4, 21.8	19.6	17.2, 22.0	19.2	16.4, 21.9	20.8	18.5, 23.0	19.3	17.1, 21.5	19.3	17.1, 21.4	22.3	19.5, 25.2	21.6	18.5, 24.6	23.2	20.7, 25.8	0.012
High-fibre breakfast cereal		10.0	8.4, 11.7	10.5	8.7, 12.2	10.3	8.5, 12.1	11.1	9.2, 13.0	11.1	9.6, 12.7	11.1	9.3, 12.9	13.5	11.6, 15.3	12.8	10.3, 15.4	13.8	11.9, 15.8	<0.001
Oil-rich fish	88 g/week	29.2	24.6, 33.8	31.6	24.6, 38.6	33.1	26.5, 39.7	34.6	27.6, 41.5	42.8	25.2, 60.5	38.2	29.9, 46.6	32.7	26.6, 38.9	32.9	25.9, 39.9	30.5	25.3, 35.7	0.641
White fish	No decrease	96.4	86.7, 106	92.7	83.2, 102	92.4	81.8, 103	86.4	77.1, 95.7	85.8	74.6, 97.1	96.5	85.9, 107	98.2	84.4, 112	93.0	80.3, 106	92.8	82.9, 103	0.849
Fresh potatoes¶		65.8	57.7, 73.9	58.1	51.9, 64.3	56.1	50.5, 61.6	53.7	47.8, 59.7	57.3	52.1, 62.5	59.8	52.0, 67.5	53.4	47.1, 59.8	54.0	46.6, 61.4	50.1	44.2, 56.0	0.007
Households (n)		619		585		546		590		566		577		500		494		543		
People (n)		1414		1342		1266		1329		1285		1365		1093		1058		1222		
People weighted (n)**		5015		4967		4952		4948		4939		4906		5040		5143		5181		

\* Expenditure and Food Survey (EFS)/Living Costs and Food Survey data (g/person per d with the exception of fish g/person per week).

† Household and eating out consumption combined.

‡ From 2006 the EFS moved from a financial year to a calendar year basis. As a consequence of this, the January–March 2006 data are duplicated in the 2005/2006 and the 2006 results.

§ Fruit includes fruit and vegetable juice.

|| Vegetables include baked beans.

¶ Part of complex carbohydrate target.

\*\* The results are weighted to the Scottish population; the number provided is approximately 1000th of the Scottish population.

**Table 5.** Intake of Scottish Diet Action Plan 1996 target nutrients by year, 2001–9†† (Mean values and 95% confidence intervals)

Scottish dietary target	2001			2002			2003			2004			2005			2006‡			2007			2008			2009			P for linear association
	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	n	
% Food energy – fat	38.8	38.1, 39.6	387	38.1	39.2	389	38.2	39.7	386	38.0	39.2	389	38.2	39.6	387	38.0	39.4	386	38.0	39.3	390	38.3	39.6	390	38.4	39.6	390	0.638
% Food energy – saturated fat	15.5	15.2, 15.8	156	15.3	15.9	156	15.2	16.0	154	15.1	15.7	154	15.1	15.7	157	15.3	16.0	153	15.0	15.6	153	15.0	15.7	151	14.8	15.4	151	0.036
% Food energy – NMEs	15.5	14.9, 16.1	156	15.1	16.1	161	15.3	16.8	155	14.8	16.2	152	14.6	15.9	150	14.4	15.7	149	14.4	15.5	150	14.4	15.6	148	14.2	15.5	148	0.005
Complex CHO (g)	146	141, 151	145	140	151	141	135	146	139	134	145	141	133	148	141	134	147	147	140	153	144	135	152	145	138	151	0.899	
NSP (g/100)	12.4	11.9, 12.9	124	11.9	12.9	121	11.6	12.7	122	11.6	12.8	125	12.0	13.0	124	11.8	13.0	127	12.0	13.3	128	12.0	13.6	129	12.2	13.5	129	0.088
Food energy (MJ)	8.7	8.4, 9.0	86	8.3	8.9	86	8.3	8.9	84	8.1	8.7	84	8.1	8.7	83	8.0	8.6	87	8.3	9.2	85	7.9	9.0	85	8.2	8.8	85	0.454
Households (n)	619			585			546		590		566		577		500		494		500		494		494		543		543	
People (n)	1414			1342			1286		1329		1285		1365		1093		1058		1093		1058		1058		1222		1222	
People weighted (n)‡	5015			4967			4952		4948		4939		4906		5040		5143		5040		5143		5143		5181		5181	

NMES, non-milk extrinsic sugars; CHO, carbohydrates; DRV, dietary reference value.

\* Expenditure and Food Survey (EFS)/Living Costs and Food Survey data (units/person per d).

† Household and eating out intakes combined.

‡ From 2006 the EFS moved from a financial year to a calendar year basis. As a consequence of this, the January–March 2006 data are duplicated in the 2005/2006 and the 2006 results.

§ DRV for adults is 11% food energy<sup>(25)</sup>.

|| DRV for adults is 18 g/d<sup>(19)</sup>.

¶ The results are weighted to the Scottish population – the number provided is approximately 100th of the Scottish population.

and 7) are presented from 2001 through to 2009. Although NSP and food energy do not form part of the SDT, they have been added for comparison with the UK Dietary Reference Values<sup>(25)</sup>.

Results are presented as population means with 95% CI in g/d for foods and drinks, with the exception of fish, which is expressed as g/week. Nutrient intakes are presented as percentage of food energy for fat, SFA and non-milk extrinsic sugars (NMES); as population mean daily intake in g/d for complex carbohydrate and NSP; and as MJ/d for food energy. The results provided are for household and eaten out purchases combined. P values are provided for linear association for analysis by year.

## Results

### Food consumption relating to the Scottish dietary targets

There were few consistent changes in consumption of the foods targeted by the SDAP and none of the SDT were met by 2009 (Table 4).

There was a slight increasing linear trend for fruit and vegetable consumption in the population from 2001 to 2009. Mean consumption for all fruit and vegetables (including fruit and vegetable juices and baked beans) was 259 g/d in 2001 and 279 g/d in 2009, which equates to almost three and a half portions per d and is considerably lower than the target of 400 g or five portions per d. The small increase in total fruit and vegetables is due to an increase in fruit consumption, with no significant change to vegetable consumption over the period, although there did appear to be a slight fall in fruit consumption and a slight increase in vegetable consumption over the last 2 years of reporting.

Total bread consumption gradually decreased over the period from 2001 to 2009 (from 111 to 95 g/d), such that the mean consumption in 2009 was significantly lower than that of 2001. This was accounted for by a steady decrease in white bread, which was only partially counteracted by an increase in brown/wholemeal bread consumption from 18 g/d in 2001 to about 23 g/d in 2006–9, the increase being equivalent to just over one-tenth of an average slice.

Total mean breakfast cereal consumption increased from 20 g/d in 2001 to 23 g/d in 2009 due to an increase in high-fibre breakfast cereal, which accounted for over half of the breakfast cereal consumption (10 g/d in 2001 and 14 g/d in 2009).

There was no overall change in oil-rich or white fish consumption over the period.

Fresh potato consumption decreased from 66 g/d in 2001 to 50 g/d in 2009.

### Nutrient intake relating to the Scottish dietary targets and other dietary guidelines

There was a small but significant decrease in the percentage of food energy from SFA, from 15.5% in 2001 to 15.1% in 2009, compared with the SDT of no more than 11%. No significant change in intake of food energy, fat, complex carbohydrate or

**Table 6.** Consumption of additional foods and drinks indicative of diet quality (sweet) by year, 2001–9\*† (Mean values and 95% confidence intervals)

Food	2001		2002		2003		2004		2005		2006‡		2007		2008		2009		P for linear association
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	
Cakes and pastries	18.1	16.0, 20.2	16.9	15.0, 18.7	16.9	14.9, 18.8	17.7	15.6, 19.7	16.4	15.1, 17.8	18.1	16.3, 20.0	17.4	15.3, 19.5	19.1	16.9, 21.2	16.1	14.6, 17.5	0.979
Sweet biscuits	21.7	20.0, 23.4	23.3	21.1, 25.5	22.1	20.0, 24.2	21.3	19.4, 23.3	19.6	17.5, 21.7	22.4	20.0, 24.8	24.0	21.3, 26.6	23.9	21.1, 26.8	22.9	20.6, 25.3	0.195
Cakes, sweet biscuits and pastries	39.8	36.9, 42.7	40.2	36.8, 43.6	39.0	35.5, 42.5	39.0	35.7, 42.3	36.0	33.3, 38.8	40.6	37.1, 44.0	41.4	37.3, 45.4	43.0	38.6, 47.4	39.0	35.7, 42.3	0.412
Sugar and preserves	19.3	16.8, 21.9	17.0	14.9, 19.2	19.8	16.4, 23.1	18.0	16.0, 20.0	15.5	13.4, 17.5	17.4	14.5, 20.3	18.9	15.7, 22.0	18.1	15.1, 21.1	16.9	13.7, 20.2	0.458
Chocolate confectionery	13.5	11.6, 15.5	14.9	13.1, 16.7	15.8	13.8, 17.8	14.6	12.5, 16.7	13.7	12.0, 15.4	13.8	12.0, 15.5	15.1	12.2, 18.1	15.5	13.2, 17.9	15.2	13.1, 17.3	0.455
Sugar confectionery	7.6	6.5, 8.7	7.9	6.6, 9.1	7.9	6.9, 8.8	7.1	6.2, 8.1	6.8	5.8, 8.0	6.6	5.4, 7.8	6.8	5.9, 7.6	6.5	5.0, 8.0	7.0	5.9, 8.2	0.029
Total confectionery	21.2	18.6, 23.7	22.8	20.3, 25.2	23.7	21.3, 26.2	21.8	19.4, 24.1	20.5	18.2, 22.8	20.3	17.9, 22.8	21.9	18.5, 25.3	22.0	18.8, 25.2	22.2	19.5, 24.8	0.769
Sugar-containing soft drinks	234	208, 260	241	215, 266	260	235, 284	246	219, 272	233	204, 263	222	196, 248	220	194, 245	213	185, 242	213	185, 241	0.007
Sugar-free soft drinks	96.2	83.0, 113	108	89.2, 126	106	86.3, 126	85.0	72.4, 97.6	84.9	67.4, 102	112	91.3, 132	86.3	65.6, 107	100	81.0, 119	78.3	62.3, 94.3	0.058
Total soft drinks	332	305, 359	348	315, 382	366	337, 395	331	299, 362	318	280, 356	334	299, 369	306	269, 342	313	271, 355	291	259, 324	0.001
Households (n)	619		585		546		590		566		577		500		494		543		
People (n)	1414		1342		1266		1329		1285		1365		1093		4058		1222		
People weighted (n)§	5015		4967		4952		4948		4939		4906		5040		5143		5181		

\* Expenditure and Food Survey (EFS)/Living Costs and Food Survey data (g/person per d)

† Household and eating out consumption combined.

‡ From 2006 the EFS moved from a financial year to a calendar year basis. As a consequence of this, the January–March 2006 data are duplicated in the 2005/2006 and the 2006 results.

§ The results are weighted to the Scottish population; the number provided is approximately 1000th of the Scottish population.

NSP was observed over the period 2001–9 (Table 5), and in 2009, the percentage of food energy from total fat remained above the SDT of no more than 35% at about 39%.

The percentage of food energy contributed by NMES rose slightly from 2001 to 2003 (from 15.5 to 16.1%), but then fell again to 14.8% in 2009 (Table 5). Intakes remain higher than the SDT for children (less than 10% of total energy) and the UK Dietary Reference Value<sup>(25)</sup> for adults (less than 11% of food energy).

*Consumption of additional foods and drinks indicative of diet quality*

Mean consumption of cakes, sweet biscuits and pastries remained fairly constant with intakes in 2009 of 39 g/d. The initial upward, followed by downward trend in sugar confectionery and sugar-containing soft drinks mirrored that for NMES (i.e. increased slightly from 2001 to 2003, but then fell again towards 2009), giving an overall fall from 7.6 g/d in 2001 to 7.0 g/d in 2009 for sugar confectionery and 234 to 213 g/d for sugar-containing soft drinks (Table 6).

Mean consumption of total red meat decreased slightly from 2001 to 2009, and this was partly accounted for by a fall in other red meat products (this group included sausages, corned beef, burgers, pâté and the meat portion of meat pies and is a component of total red meat). Bacon and ham intakes have remained constant over the same time period. Total milk consumption decreased from 250 g/d in 2001 to 232 g/d in 2009. This resulted from a decrease in whole milk from 92 to 60 g/d. There was a slight increase in intakes of skimmed milk. The decrease in whole milk and total red meat is compatible with the drop in SFA. Processed potato (e.g. chips) and savoury snack (including potato crisps) consumption has decreased slightly over the period from 33 g/d in 2001 to 29 g/d in 2009 and from 14 g/d in 2001 to 13 g/d in 2009, respectively. Takeaway food consumption between 2001 and 2009 has remained fairly constant at about 21 g/d (Table 7).

**Discussion**

Small but significant changes in the Scottish Diet for the 9 years from 2001 to 2009 have been found using a standardised methodology developed to calculate food consumption and nutrient intake from the EFS/LCF. Although the method of data collection has remained the same over this period, it should be noted that the formulation of the dietary targets for Scotland was based on an earlier method.

The ‘present daily intake’ figures quoted in Table 1 and published in the SDAP in 1996<sup>(8)</sup> were originally derived mainly from the NFS of 1989–91, and were therefore an estimate of food and nutrient intake at that time. A major limitation is that the 1989–91 NFS did not include food and drink eaten outside the home or sweets and confectionery. In addition, the calculations used to derive certain food groups, e.g. fruit and vegetables, did not include canned, dried and juiced foods. Defra attempted to adjust results of the NFS to make them comparable to the EFS<sup>(26)</sup>, but this



**Table 7.** Consumption of additional foods and drinks indicative of diet quality (not sweet) by year, 2001–9\*†  
(Mean values and 95% confidence intervals)

Food	2001		2002		2003		2004		2005		2006‡		2007		2008		2009		P for linear association
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	
Total red meat§	64.6	59.9, 69.3	64.5	60.7, 68.4	66.3	62.2, 70.3	61.1	57.3, 64.9	62.1	58.3, 65.9	60.1	56.3, 63.9	64.8	58.6, 71.0	58.1	52.3, 63.9	61.1	5.0, 65.1	0.039
Bacon and ham	12.4	11.1, 13.7	11.7	10.5, 12.9	12.4	11.1, 13.8	11.4	10.4, 12.4	11.8	10.8, 12.8	11.9	10.6, 13.2	12.0	10.8, 13.2	11.9	10.5, 13.2	12.7	11.6, 13.9	0.694
Other red meat products¶	28.8	26.1, 31.6	28.6	26.5, 30.7	30.9	28.9, 32.9	27.1	24.8, 29.5	28.6	26.2, 30.9	25.5	23.2, 27.7	28.5	26.4, 30.5	24.9	21.8, 27.9	27.7	25.4, 30.1	0.021
Butter	6.1	5.2, 7.1	5.7	4.9, 6.6	5.6	4.3, 6.9	6.1	5.1, 7.0	6.8	5.6, 8.0	7.3	6.0, 8.5	7.4	6.2, 8.6	6.3	5.2, 7.4	5.7	4.8, 6.7	0.239
Whole milk	91.6	75.8, 107	85.2	72.9, 97.5	89.7	74.1, 105	68.1	56.2, 79.9	59.2	47.1, 71.2	71.4	56.9, 85.8	59.2	48.1, 70.3	52.9	38.0, 67.8	59.5	46.0, 72.9	<0.001
Semi-skimmed milk	12.6	11.1, 14.0	12.5	11.3, 13.8	12.5	11.2, 13.7	12.4	11.0, 13.8	13.6	12.2, 15.0	12.7	11.3, 14.1	13.9	12.5, 15.3	13.7	12.1, 15.4	13.8	12.0, 15.6	0.061
Skimmed milk	14.8	8.9, 20.8	12.5	8.6, 16.5	9.2	6.0, 12.5	13.4	8.6, 18.2	14.1	9.1, 19.1	14.4	10.6, 18.1	13.8	9.2, 18.5	18.9	13.9, 23.8	17.8	13.0, 22.6	0.045
Total milk	250	235, 266	249	235, 264	245	227, 263	227	210, 243	225	211, 239	233	217, 248	234	220, 248	226	207, 245	232	214, 251	0.024
Processed potatoes	32.8	29.7, 36.0	32.8	29.8, 35.7	31.9	28.9, 34.9	28.0	25.5, 30.5	27.5	24.2, 30.8	28.1	25.3, 30.8	28.7	25.5, 32.0	26.8	23.3, 30.3	29.1	26.1, 32.0	0.001
Savoury snacks¶	14.6	13.3, 16.0	14.4	13.1, 15.7	14.6	13.5, 15.8	12.0	10.8, 13.2	12.5	11.1, 13.9	12.4	11.3, 13.5	12.4	11.3, 13.5	13.5	10.6, 14.0	13.5	12.3, 14.7	0.028
Takeaway foods	19.9	17.2, 22.6	23.9	21.0, 26.8	21.0	18.4, 23.7	19.9	16.8, 22.9	20.5	17.2, 23.7	21.0	18.1, 23.9	21.0	17.7, 24.4	18.1	15.5, 20.6	21.3	17.9, 24.6	0.349
Households (n)	619		585		546		590		566		577		500		494		543		
People (n)	1414		1342		1266		1329		1285		1365		1093		1058		1222		
People weighted (n)**	5015		4967		4952		4948		4939		4906		5040		5143		5181		

\* Expenditure and Food Survey (EFS)/Living Costs and Food Survey data (g/person per d).

† Household and eating out consumption combined.

‡ From 2006 the EFS moved from a financial year to a calendar year basis. As a consequence of this, the January–March 2006 data are duplicated in the 2005/2006 and the 2006 results.

§ Meat portion only – see appendices 2 and 4 of ref. (15) for methodology.

¶ Other red meat products include the meat portion of sausages, meat pies, corned beef, burgers and pate, and is a component of total red meat.

|| Includes potato crisps.

\*\* The results are weighted to the Scottish population; the number provided is approximately 1000th of the Scottish population.

was done after the SDAP was published. Given that several changes were made to the NFS over the period 1989–2000, it is not feasible to calibrate the present results to match those when the original targets were proposed.

The EFS/LCF is a very comprehensive source of information on food consumption and nutrient intake for the Scottish population and is carried out annually. It should be noted that the EFS/LCF has been carried out every year since 2001 using the same methodology. The main limitation of the EFS/LCF is that it is based on records of household food purchases analysed to provide population data (per average person) and not on dietary assessment of individuals. However, it has been noted by Chesher<sup>(27)</sup> that, because of the relatively unobtrusive data collection method of household food surveys, this methodology may result in reduced under-reporting and a less biased response (because the food records are not related to specific individuals). In addition, the EFS/LCF collects quantitative information on diets over 14 d, a longer period than other dietary assessment methods, such as that used in the NDNS, and also has a larger sample size than results reported from the NDNS in Scotland (*n* 114 in the 2001/2002 survey)<sup>(16)</sup>.

The present results indicate a small, but statistically significant, increase in mean consumption of fruit and vegetables in the population over the 9 years from 2001 to 2009. This increase is mostly explained by an increase in fruit rather than in vegetable intake. However, mean fruit and vegetable consumption remains about 1.5 portions below the population target of 5 portions per d. Despite the small but encouraging increase from 2001 levels, consumption appears to have dropped slightly over the period 2007–9, which may be in response to the economic situation and rising prices<sup>(28)</sup>. Assuming a similar rate of increase observed over the 9-year period (4 g/year estimated from the regression equation), it will take 29 years to meet the >400 g/d SDT.

Total bread consumption fell over the period 2001–9, a trend away from the SDT, although it appears that there may have been a shift in the type of bread being consumed, as consumption of brown/wholemeal bread increased slightly. Consumption of breakfast cereals and the proportion contributed by high-fibre breakfast cereal also increased slightly, but in 2009 was still equivalent to less than a bowlful per person per d. There has been a small decrease in consumption of fresh potatoes, which could be due to consumers favouring ready-to-cook processed potatoes, but these too have decreased (Table 7). Overall, fish consumption has remained fairly static and the observed increase in oil-rich fish from 2001 to 2006 was not maintained.

Nutrient intake data from the EFS/LCF suggest that the percentage of food energy from dietary fat and intake of complex carbohydrates have not changed over the 9-year time period and continue to be significantly higher than the SDT for total fat and lower for complex carbohydrate. The SFA and NMES intakes are moving slowly in the desired direction, but are still higher than the SDT. The regression equations show that the change in SFA is –0.044% of energy per year, equivalent to approximately 3.7 kJ (based on an average intake of 8.4 MJ), i.e. about 0.1 g SFA, which is similar to the



SFA in the reduction seen in whole milk consumption (2.5% of 4.7 g/year = 0.12 g). If the present rate of reduction in the percentage of energy from SFA continues, it could take over 100 years to reach the SDT. Although these are statistically significant changes, in terms of nutritional and clinical significance, they are very small dietary changes.

The food and nutrient intakes estimated for Scottish adults in the NDNS 2000/2001 survey were similar to those of the results of this secondary analysis of Scottish Data from the EFS, despite the different methodologies used in the two surveys<sup>(29)</sup>. Both surveys confirmed that food consumption and nutrient intakes were far from meeting the SDT. The exception is the NDNS data for total fat, which was 35.3% of food energy. This figure differs from the 38.8% of energy estimated for the same period from the EFS data and may be due to the fact that NDNS participants selectively underreported foods high in fat<sup>(30)</sup>. Alternatively, it could be that intake of fat appears higher because participants purchase quantities of oils and fats that are meant to be consumed over a longer period. However, it is assumed that this will be balanced by those who do not purchase these items during the period because they have sufficient in storage.

Mean daily intakes of foods from the 2001/02 NDNS<sup>(31)</sup> survey compared with those obtained from the 2001 EFS were similar for fruit and vegetables (when all fruit juice, baked beans and fruit and vegetables in composite dishes are included; 267 g/d<sup>(29)</sup> compared with 259 g/d from the EFS). There are no separate Scottish figures for the latest NDNS, but the UK intake of fruit and vegetables, as defined earlier, was 350 g/d for 19- to 64-year-old adults (compared with 273 g in 2001/02). This increase may be due to the change from weighed to estimated intakes, but is considerably greater than that seen for the Scottish EFS/LCF analysis, where intakes only increased to 279 g/d in 2009. In the 2003 Scottish Health Survey<sup>(32)</sup>, the mean frequency for fruit and vegetable consumption was 3.1 portions per d, which is comparable to an intake of about 248 g/d if an average portion size of about 80 g is assumed<sup>(14)</sup>. No statistically significant increase was apparent from 2003 to 2009 with mean intakes in 2009 of 3.3 portions per d, comparable to an intake of about 264 g/d<sup>(33)</sup>. From this it can be deduced that fruit and vegetable intake in England (the majority of the consumers in the NDNS) is considerably higher than that in Scotland, and comparative figures given in the Family Food 2009 report confirm this<sup>(34)</sup>. The consequences of this difference on the mortality rates from CHD, stroke and cancer in Scotland, compared to England, have recently been explored by Scarborough *et al.*<sup>(35)</sup>. Using a macrosimulation model, which incorporated the results from the LCF, they predicted that if Scotland had an average diet 'equivalent in nutritional quality' to England, 40% of this mortality gap would be removed.

Total bread intake in both the EFS and the NDNS in 2001 was similar, and median consumption figures of zero for wholemeal bread (for both Scotland and the whole of Great Britain) indicated that the majority of the participants were non-consumers (a fact that cannot be appreciated with the mean figures estimated from the EFS). Breakfast cereal consumption in the NDNS 2001/02 survey was higher for both

total and wholegrain/high-fibre varieties than the EFS and the reason for this is unknown. It is not possible to compare the NDNS 2008/2009 figures for bread and breakfast cereals without further analysis. Comparison of oil-rich fish consumption in 2001/2002 surveys is complicated by the fact that canned tuna was included in the NDNS figures. However, this was excluded in the latest survey<sup>(31)</sup> and estimates of mean intakes were about 8 g/d, i.e. 56 g/week for the UK, almost double the estimate for Scotland from the EFS/LCF.

Fat, SFA and NMES intakes, expressed as percentage of food energy, were lower in both the NDNS 2001/02 (Scottish sample)<sup>(29)</sup> and the latest NDNS<sup>(31)</sup>, and nearer to the SDT. This highlights the difficulties in deciding whether the Scottish population is meeting the target for fat consumption. It must also be remembered that it is not possible to give mean intakes for different age groups in the EFS/LCF and that the comparative figures from the NDNS are for adults aged 19–64 years. It is known from the recent NDNS that children's intakes of SFA and NMES are considerably higher in some age groups, e.g. 11- to 18-year-old boys recorded a NMES intake of 16% of food energy<sup>(31)</sup>. As the SDT are population targets (with the exception of the separate target set for NMES for children and adults), the results of the EFS/LCF analysis, which covers the whole population, could be considered more appropriate.

### Conclusion

A robust standardised methodology has been designed, developed and tested to calculate food and nutrient intakes on a population basis, which can be used to continue to monitor the Scottish diet in the future. The results reported in the present study suggest only small improvements in consumption of fruit and vegetables, brown/wholemeal bread and high-fibre breakfast cereals and only a slight reduction in SFA and NMES intake over a 9-year period, i.e. up to 2009.

The lack of progress has significant implications for the design of government policy aimed at improving food and nutrient intake in Scotland. The Scottish Government has reaffirmed the importance of tackling poor diet and is committed to renewing the population-level dietary targets/goals to provide future impetus and set the direction for the changes needed to improve the diet. The national dietary improvement is a key factor in reducing the burden of preventable and common diet-related diseases such as cancer, diabetes and heart disease, as well as the prevalence of overweight and obesity, now at record levels in Scotland. Continued monitoring of dietary intake is essential in assessing future progress and cost effectiveness of European and national policy initiatives or action to change dietary intake.

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