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# Survey of sugar intake among children in Scotland

## Summary report

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The full report can be downloaded from the FSA website: www.food.gov.uk/scotland

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# Introduction

Diet is an important determinant of health. In 1996 dietary targets for the Scottish population were published in *Eating for Health: A Diet Action Plan for Scotland*[1] (Table 1).

**Table 1: Scottish Dietary Targets**

| Food or nutrient | Target |
|---|---|
| Fruit and vegetables | Average intake to double to more than 400g per day. |
| Bread | Intake to increase by 45% from present daily intake of 106g, mainly using wholemeal and brown breads. |
| Breakfast cereal | Average intake to double from the present intake of 17g per day. |
| Fats | Average intake of total fat to reduce from 40.7% to no more than 35% of food energy.<br>Average intake of saturated fatty acids to reduce from 16.6% to no more than 11% of food energy. |
| Sodium | Average intake to reduce from 163 mmol per day to 100 mmol per day (the equivalent of 6g salt). |
| Sugar | Average intake of non-milk extrinsic sugars in adults not to increase.<br>Average intake of non-milk extrinsic sugars in children to reduce by half to less than 10% of total energy. |
| Total complex carbohydrates | Increase average non-sugar carbohydrates intake by 25% from 124g per day through increased consumption of fruit and vegetables, bread, breakfast cereals, rice and pasta and through an increase of 25% in potato consumption. |
| Fish | White fish consumption to be maintained at current levels.<br>Oil-rich fish consumption to double from 44g per week to 88g per week. |
| Breastfeeding | The proportion of mothers breast-feeding their babies for the first 6 weeks of life to increase to more than 50% from the present level of around 30%. |

The present survey was commissioned to address the recommendation of the Working Group on Monitoring Scottish Dietary Targets that 'where data is currently lacking, as for non-milk extrinsic sugars in children, interim studies may need to be set up'.[2]

The focus of the present survey was the intake of sugars and sugar-containing foods by children in Scotland. However because total energy intake was measured it was possible to determine the intake of other macronutrients in particular intake of total fat and saturated fatty acids and relate these to Scottish Dietary Targets.

Sugars in this report have been defined according to *The Department of Health report on Dietary Sugars and Human Disease* [3] proposed classification:

- Intrinsic sugars: sugars forming an integral part of certain unprocessed foodstuffs, i.e. enclosed in the cell, the most important being whole fruits and vegetables
- Extrinsic sugars, which are not located within the cellular structure of a food can be further divided into:
  - Milk sugars, occurring naturally in milk and milk products
  - Non-milk extrinsic sugars, which includes fruit juices, honey, and 'added sugars' which comprise both recipe sugars and table sugars.

Total sugars have been be divided into intrinsic and milk sugars (IMS) and non-milk extrinsic sugars (NMES). Information on the NMES and IMS content of foods was obtained from the NDNS nutrient databank[4].

# Aims of the survey

The 'Survey of sugar intake among children in Scotland' was commissioned by the Food Standards Agency Scotland (FSAS) in 2005 to provide robust information on the diet of children in Scotland. The survey was carried out by a consortium of four organisations: the Scottish Centre for Social Research, the University of Aberdeen, the Rowett Research Institute and King's College London. Fieldwork for the survey was conducted between May and September 2006.

The principal aim of the survey was to estimate intake of NMES and other macronutrients and foods in a nationally representative sample of children in Scotland aged 3-16 years.

Additional objectives were:

- To compare the intake of NMES and other macronutrients and micronutrients between sub-groups divided by age, sex, deprivation category and rural-urban residence
- To estimate the prevalence of overweight and obesity in all children and in sub-groups divided by age, sex, deprivation category and rural-urban residence
- To investigate associations between energy, NMES and fat intake and overweight and obesity in all children and in sub-groups divided by age and sex
- To determine the levels of physical activity in all children and in sub-groups divided by age, sex, deprivation category and rural-urban residence
- To assess associations between physical activity and inactivity and overweight and obesity in all children and in sub-groups divided by age and sex
- To assess dental health in all children and in sub-groups divided by age, sex, deprivation category and rural-urban residence
- To assess associations between NMES intake and dental health in all children and in sub-groups divided by age and sex

# Main survey methods

Using the Department of Work and Pensions Child Benefit records, a named sample of 2800 children aged between 3 and 16 years on 1st May 2006 was drawn from 80 postcode sectors across Scotland. One child per household was selected. After exclusions and an initial opt out period, a Food Frequency Questionnaire (FFQ) was sent to the remaining 2,498 children in the sample. Two versions of the FFQ were used: one for children aged 3-11 years in which the instructions were addressed to the parent or guardian, and one for young people aged 12 or above which included alcoholic drinks, in which the instructions were addressed to the young person.

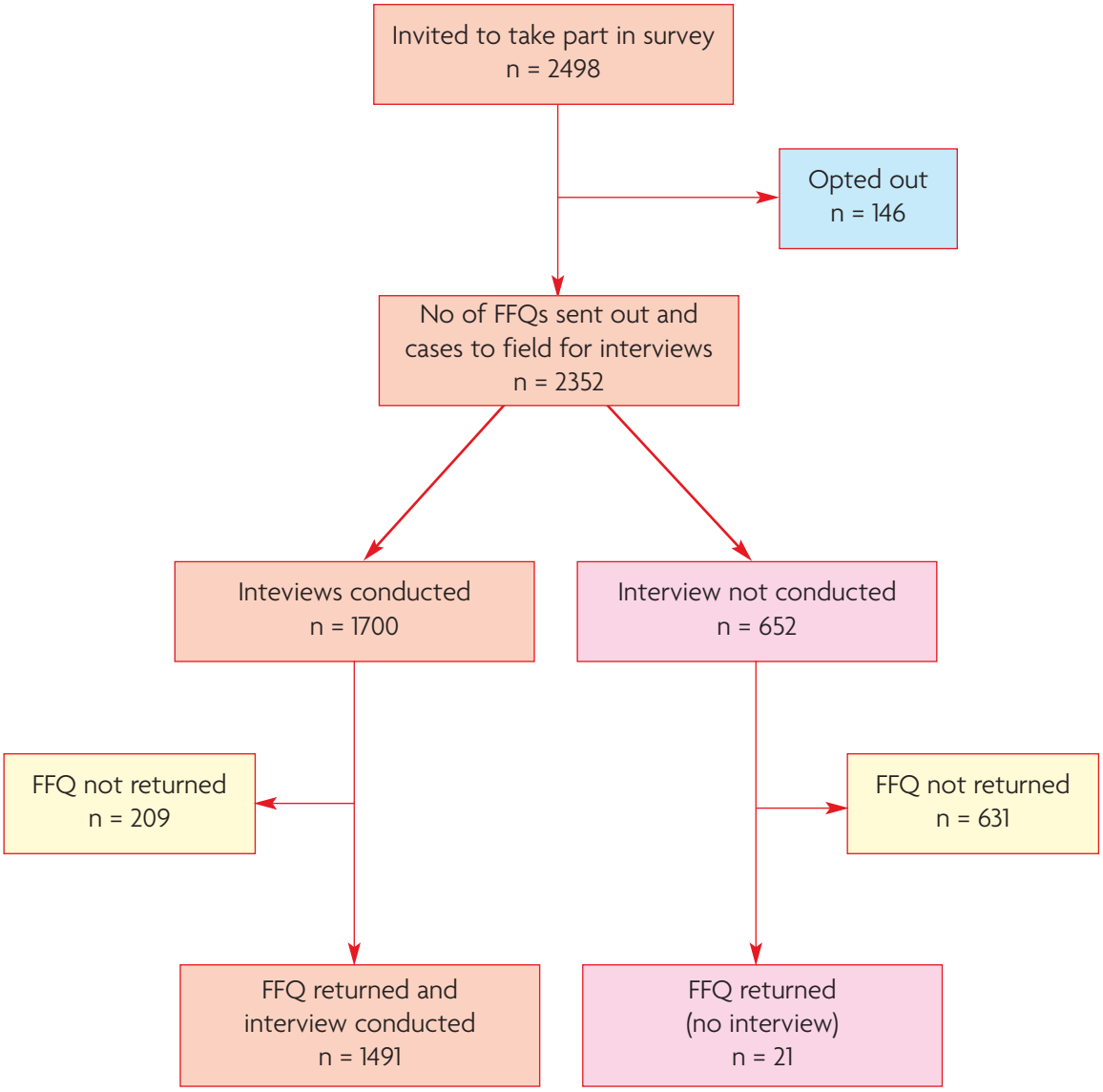
The FFQ was collected by an interviewer when they called to conduct an interview. The child's height and weight were also measured and information on household composition and socio-demographic data was collected. Socio-economic status was based on the Scottish Index of Multiple Deprivation (SIMD) derived from postcode. The FFQ was compared with a 4 day non-weighed diet diary in 153 children and a single 24-hour multiple pass recall in 350 children (see Appendix).

Face to face interviews were conducted with 1,700 respondents and 1,512 FFQs were returned giving a combined response rate for these two items of 66%. Response rates for combined FFQ and interview were highest amongst those in the 8-11 year age group for both sexes (71% for both). Figure 1 shows the response to the FFQ and interview.

Of the 1,512 FFQs returned, 51 were rejected as incomplete and a further 70 were excluded as having very high or very low values of energy intake, leaving 1,391 questionnaires for the main analyses.

Results for all analyses using the interview and FFQ data were weighted to allow for selection and non-response bias within the initial sample so that the estimates generated from the responding sample more closely reflect the population of all children in Scotland aged 3-16 years. In addition, all variables which were significantly skewed were transformed to achieve a normal distribution. This was necessary to allow statistical testing of associations between diet and demographic and health variables.

Figure 1: Response to FFQ and interview



# Results

## Dietary assessment

### *Intake of energy and sugars*

The mean energy intake recorded by the FFQ was 8.01 MJ (1,901 kcal) per day in boys and 7.35 MJ (1,746 kcal) per day in girls. Energy intake increased with age in boys but not in girls. Higher energy intake was associated with increasing deprivation.

The mean intake of NMES as % food energy was 17.4% of which sucrose provided 13.4%. NMES as % food energy intake increased with age from 15.8% in the 3-7 year olds to 19.1% in the 12-17 year olds. There were no significant differences in the NMES as % food energy between boys and girls. NMES intake as a percentage of food energy was considerably higher at 17.4% than the UK recommended population average (10% of total energy or 11% of food energy)[5] and the Scottish Dietary Target for children (<10% of total energy)[1].

Total sugar intake did not differ significantly between the SIMD quintiles, but in the more deprived quintiles NMES contributed a higher proportion of food energy and intrinsic and milk sugars (IMS) contributed a lower proportion of food energy. However even in the least deprived quintile the intake of NMES as % food energy was high at 16.3% (Table 2).

Table 2: Mean energy intake (MJ) and total sugar, NMES and IMS intake (all as % food energy) by SIMD

| | Scottish Index of Multiple Deprivation Quintile | | | | | P value for overall association | P value for linear association |
|---|---|---|---|---|---|---|---|
| | Ist* | 2nd | 3rd | 4th | 5th** | | |
| Energy | 7.51 | 7.49 | 7.44 | 8.05 | 7.98 | 0.018 | 0.002 |
| Total sugars | 28.7 | 29.0 | 28.8 | 29.3 | 28.9 | 0.703 | 0.517 |
| NMES | 16.3 | 17.4 | 16.8 | 18.1 | 18.4 | 0.003 | 0.001 |
| IMS | 11.4 | 10.6 | 11.0 | 10.2 | 9.5 | <0.001 | <0.001 |

** Least deprived, ** Most deprived*

### *Intake of food groups and supplements*

Over 95% of children reported consuming: pasta, rice and pizza; bread (excluding wholemeal); biscuits, cakes and pastries; milk and cream; yoghurt and fromage frais; meat and meat dishes; processed meat; vegetables; chips; crisps and savoury snacks; fruit; confectionery and soups and sauces at least once a month: 59% of children reported consuming wholemeal bread and 39% oily fish and dishes at least once a month. Younger children were more likely to consume wholemeal bread, unsweetened breakfast cereals, yoghurt and fromage frais, ice-cream, fats and oils and white fish, shell fish and fish dishes. Older children were more likely to consume chips, fried and roast potatoes and potato products, nuts and seeds, non-diet soft drinks and beverages.

Those living in less deprived areas (as defined by quintile of SIMD) were more likely to consume wholemeal bread, cheese, oily fish and fish dishes and fruit juice and less likely to consume diet soft drinks than those living in more deprived areas.

23% of children were taking a dietary supplement, with higher proportions in younger than older children and in boys than girls. Multivitamins (12%) and cod liver oil (9%) were the most common types of supplements taken.

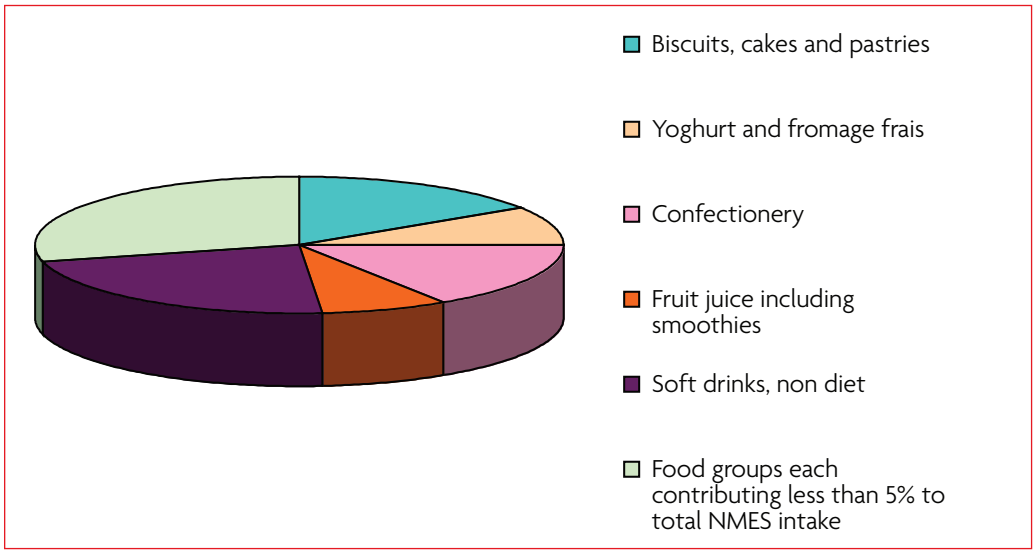
*Contribution of food groups to intake of energy and sugars*

The food groups contributing the highest proportion of total energy intake were biscuits, cakes and pastries (9%) and bread excluding wholemeal (8%). Non-diet soft drinks were the major contributors to NMES (17%), along with confectionery (12%) and biscuits, cakes and pastries (12%) (Figure 2).

There were highly significant linear associations between the SIMD quintiles and the percentage contribution of several food groups to both energy and sugars intake. Children in the more deprived areas derived a lower proportion of energy from pasta, rice and other cereals and a higher proportion from crisps and savoury snacks than children in the less deprived areas. Children in more deprived areas also obtained a lower proportion of total sugars from fruit, and a higher proportion from confectionery and non-diet soft drinks.

There was a more marked pattern for the contribution of food groups to NMES intake than for other sugars. This was particularly the case for drinks. Children in the more deprived areas obtained a higher percentage of NMES from non-diet soft drinks (23% in the most deprived quintile vs. 14% in the least deprived quintile) and a lower percentage from fruit juice (3% in the most deprived quintile vs. 9% in the least deprived quintile).

Figure 2: Percentage contribution of food groups to NMES intake



*Intake of fat and saturated fatty acids*

The overall intake of total fat and saturated fatty acids as % food energy were 32.9% and 13.8% respectively. There were no significant differences between boys and girls in the intake of total fat or saturated fatty acids as % food energy. The intake of total fat was not significantly different between the age groups but the intake of saturated fatty acids as % food energy was significantly higher in the 3-7 year olds. There was no significant association between total fat or saturated fatty acids as % food energy and SIMD.

There were significant differences and a linear association between deprivation and the contribution of processed meats, crisps and savoury snacks to the intake of total fat and saturated fatty acids. The intake of these food groups increased with increasing deprivation.

The mean intake of total fat as % food energy (32.9%) was lower than the UK recommended population average (35%) and the Scottish Dietary Target (≤35%) in all age and sex groups. The mean intake of saturated fatty acids (13.8%) was above the recommended level of 11% food energy in all age and sex groups.

*Comparison of NMES and total fat and saturated fatty acids as % food energy with other UK-wide diet surveys in children*

The results for NMES were slightly higher than values reported in other UK-wide dietary surveys, but the results for total fat and saturated fatty acids were a little lower than values reported in the same surveys (Table 3).

Table 3: Comparison with other UK-wide diet surveys in children

| % food energy | Present Scottish survey 2006 (age 3-16y) | LIDNS[6] 2004 (age 2-18y) | NDNS[7] 1997 (age 4-18y) |
|---|---|---|---|
| **NMES** | | | |
| Boys | 17.4 | 17.1 | 16.7 |
| Girls | 17.4 | 16.5 | 16.4 |
| **Total fat** | | | |
| Boys | 32.9 | 36.1 | 35.4 |
| Girls | 33.0 | 35.7 | 35.9 |
| **Saturated fatty acids** | | | |
| Boys | 13.9 | 14.2 | 14.2 |
| Girls | 13.7 | 14.0 | 14.3 |

## Overweight and Obesity

Overall the prevalence of overweight and obesity, using UK reference data[8] was 14% and 17% respectively which was similar to that reported in the 2003 Scottish Health Survey (SHS)[9]. There were no significant differences between the sexes in the prevalence of overweight and obesity overall, 13% of boys and 15% of girls were overweight and 16% of boys and 18% of girls were obese.

There was no evidence of a linear association between BMI and deprivation. Children in the least deprived (1st) quintile had the lowest mean BMI (17.9 $kg/m^2$) while those in the 2nd quintile had the highest (18.6 $kg/m^2$).

There was an overall association but no linear association between prevalence of the combined category of *overweight including obese* and SIMD. The highest proportion of children in the *overweight including obese* category appeared in the middle (3rd) quintile, (33% boys and 38% for girls). The lowest proportion of children in this category was in the least deprived (1st) quintile (25% for both sexes).

There was little evidence for differences in the intake of foods or nutrients between the children who were *neither overweight nor obese* and the overweight or obese children. However, it is recognised that cross-sectional analysis may be affected by dietary restraint in the overweight and obese groups or by differential reporting bias between overweight and obese and non-overweight or obese children, and that these effects could obscure relationships between diet and weight gain.

## Physical Activity

Children's physical activity levels were categorised as:

- High: active for 60 minutes on 7 days in the last week.
- Medium: active for 30-59 minutes on 7 days in the last week.
- Low: active at a lower level or not active at all.

Any activity during school lessons was not included in these estimates.

Overall, 86% of children reached the 'high' activity level – the current recommended level for children, though it should be noted that fieldwork for this survey was conducted over the summer months including the school summer holidays when activity levels may have been higher than at other times of year.

More boys reached the high level of physical activity than girls (89% vs. 83%). A further 5% of boys and 9% of girls reached the medium activity level. There was a decline in activity levels in the 12-17 year age group in both sexes but the decline was greater for girls than boys.

There was no clear pattern in the relationship between those meeting the physical activity recommendations and deprivation.

*Time spent at a screen*

Boys spent an average of 2.2 hours a day and girls 2.0 hours a day sitting in front of a screen (TV, computer or video game). The time spent in front of a screen increased linearly with age group for both sexes, 14% of both boys and girls, aged 12-17 years, spending on average 4 hours a day in front of a screen compared to 5% of boys and 4% of girls in the youngest age group (aged 3-7 years).

*Physical Activity and BMI*

To examine the levels of physical activity by BMI, children were classified into one of two BMI groups; *neither overweight nor obese* or *overweight including obese*.

A higher proportion of children in the neither overweight nor obese category reached the recommended level compared with those in the overweight including obese category (88% vs. 81%). The differences were not significant for the oldest age group (12-17 year olds).

For all children and for boys alone there was a significant association between BMI category and time spent sitting in front of a screen. A higher proportion of children in the *overweight including obese* category reported spending more than 3 hours in front of a screen than those in the *neither overweight nor obese* category (25% vs. 20%). For boys the proportions were 28% vs. 21%.

## Dental Health

Over half (56%) of all children had received treatment for decay (either fillings or teeth taken out), and the likelihood of having received treatment for decay increased with age. The proportion of children receiving treatment for decay rose from 26% among 3-7 year olds to 74% among 12-17 year olds.

Treatment for decay was associated with increasing deprivation in both sexes. Boys in the most deprived quintile were twice as likely to have had treatment for decay as boys in the least deprived quintile (71% vs. 35% respectively). For girls the difference between the highest and lowest quintiles was not as great (65% vs. 43%).

*Association between diet and dental disease*

NMES intake was significantly higher in children who had received treatment for decay (mean 18.5% food energy) than in children who had not (mean 16.1% food energy). This difference was significant in boys and in girls, and was more evident in older children than in younger children. There was no association between total sugars intake and treatment for decay. Children who had received treatment for decay had significantly higher intakes of biscuits, cakes and pastries, confectionery, crisps and savoury snacks, and non-diet soft drinks than children who had never received treatment for decay.

# Conclusions

The study provides clear evidence that the intake of NMES was considerably higher than the Scottish Dietary Target of <10% of total energy in all children and in all sub-groups. The intake of NMES was particularly high in older children and those living in more deprived areas, mainly due to high consumption of non-diet soft drinks, confectionery, biscuits, cakes and pastries. The mean NMES intake was significantly higher in children who had been treated for dental decay suggesting that the high intake of NMES is likely to be contributing to dental disease. There was little evidence from this study that differences in the intake of foods or nutrients between children was associated with overweight or obesity, possibly due to underreporting or dietary restraint in the overweight and obese groups. However, as obesity results from an imbalance between energy intake and expenditure, reducing intake of energy by reducing NMES intake could make a positive contribution to prevention of overweight and obesity as well as bringing the diet more in line with dietary recommendations.

## Implications for further research

- Use of the Child Benefit records as the sampling frame should be considered in any future study monitoring children's diets in Scotland.
- This survey provides a sound baseline for future studies of NMES and fat intake of children in Scotland, which could be used for monitoring the impact of Scottish policy initiatives aimed at improving children's diet.
- The FFQ as used in this study proved to be a cost effective and robust method for measuring intake of NMES, total fat and saturated fatty acids as percentage food energy.
- The results provide baseline data which could be developed as a longitudinal study of diet and health. This could present more useful information on the relationship between diet and the development of overweight and obesity. A longitudinal study of the present survey population could also investigate whether low physical activity precedes or succeeds weight gain.
- To investigate whether the energy intake of *overweight or obese* children is under-reported to a greater extent than *neither overweight nor obese* children an objective estimate of energy intake would be required e.g. using doubly labelled water to measure habitual energy expenditure.
- The possibility of an association between physical activity (or inactivity) and intake of energy, NMES, total fat and saturated fatty acids could be explored. However, more detailed information on the type, intensity and duration of activities would be beneficial.

- The fact that there was no association between total sugars intake and treatment for tooth decay but there was a clear association with NMES intake suggests that this component of foods contributes to the risk of dental decay and also suggests that the FSA's current sugars classification is useful in identifying the components of the diet which adversely affect dental health.

## Implications for health improvement

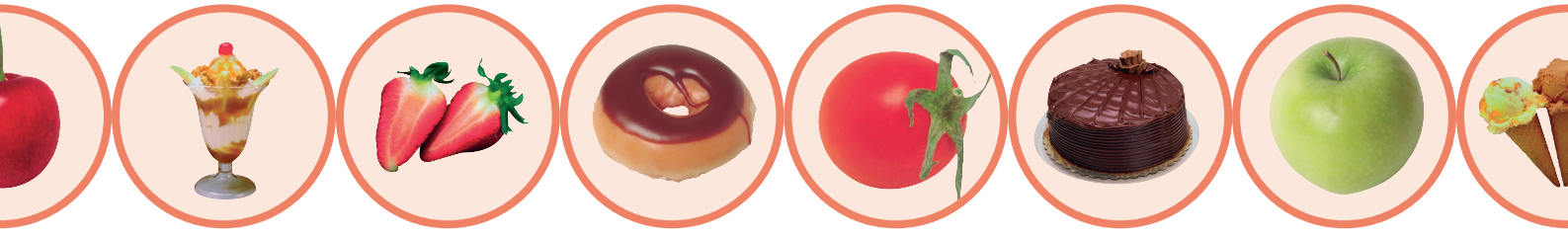
- The main finding of the present survey was that the intake of NMES as % food energy was much higher than recommended in the whole population and in all sub-groups. The foods contributing to NMES varied significantly with socio-economic status, therefore in order to reduce the levels of NMES intake different approaches may be needed in different sectors of the population.
- Scottish policy initiatives such as 'Hungry for Success'[10] which focus on improving the provision of food in schools should have beneficial effects on NMES intake within schools but wider initiatives may be needed to reduce the intake of foods high in NMES outside schools to reach the recommended level of intake.
- The results of the present survey highlights the magnitude of dietary change required to reach the dietary targets for NMES, total fat and saturated fatty acids in Scotland. To meet current Scottish dietary targets the intake of NMES (g/d) would have to decrease by 40% and the intake of saturated fatty acids (g/d) by 20%. To achieve these targets and significantly improve the diets of children in Scotland, intakes of non-diet soft drinks, biscuits, cakes and pastries and confectionery need to be severely restricted and most of the energy provided by these foods replaced by encouraging the consumption of foods rich in complex carbohydrate such as bread, potatoes, rice, and pasta.
- Overall, a major change in children's dietary habits is required to a) reduce consumption of sugary drinks and snacks, b) improve the balance of meal composition to include less saturated fatty acids and sugar and more complex carbohydrates. To support parents and children to achieve this change a wide range of initiatives addressing food marketing and catering practices, nutrition knowledge and the cooking skills of parents and children are essential.

## Recommendations

Consideration should be given to repeating this survey at regular intervals to provide data on ongoing progress made towards Scottish Dietary Targets for NMES and saturated fatty acid intake. Such a survey would also serve to evaluate the impact of policy initiatives directed at improving children's diet.

Measures need to be taken to reduce the high intake of the main sources of NMES identified in this survey, namely non-diet soft drinks, biscuits, cakes and pastries and confectionery.

Research is needed to develop interventions to reduce intake of NMES and saturated fatty acids in children's diets to reach the Scottish Dietary Targets. In addition, measures need to be taken to ensure that a reduction in NMES and saturated fatty acids is accompanied by an increase in foods rich in complex carbohydrate to provide a healthy, balanced diet.



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# Appendix

## Comparison of methods of dietary assessment

The methodology for assessing intake in dietary surveys needs to be carefully chosen to be fit for purpose according to the population group and the nutrients of interest. For the present study, Food Frequency Questionnaires (FFQ) were considered to be the most appropriate method due to the ability to estimate intake over several months and the cost-efficiency for a large-scale survey.

To evaluate the FFQ method compared with 24-hour multiple pass recall and diet diaries, two randomly selected sub-samples were drawn from the whole sample. One sub-sample was asked to complete a four day diet diary, the other, drawn from only 40 of the postcode sectors, was asked to complete a single 24-hour recall.

A total of 186 diaries (60%) were completed and returned and 424 24-hour recalls (99%) were completed.

Nutrient intakes as recorded by the FFQ and either the diet diary or 24-hour recall were compared for 153 and 350 children respectively. Energy intake from the FFQ was 10.5% higher that that from the diet diary and 5.5% higher than that for the 24-hour recall. The difference in energy intake between the FFQ and diet diary was greater in children aged 3-11 years (14.6%; $p<0.001$) than those aged 12-17 years (5.6%; $p>0.05$).

In the diet diary sub-group the intake of NMES (% food energy) as recorded by the FFQ (16.0%) was not significantly different from that recorded by the diet diary (14.9%). In the 24-hour recall sub-group the intake of NMES (% food energy) as recorded by the FFQ was also very similar by the FFQ (17.4%) and the 24-hour recall (16.6%) though this difference was statistically significant. There was no significant difference in intake of total fat or saturated fatty acids as % food energy between the FFQ and either the diet diary or the 24-hour recall. Absolute intakes of iron, calcium and all macronutrients apart from protein were all significantly higher as recorded in the FFQ than in the diet diaries or the 24-hour recall.

It was concluded that the FFQ provided reliable estimates of NMES, total fat and saturated fatty acids as % food energy. Intakes of other nutrients from the FFQ should not be compared with absolute values such as recommendations, though may be of value in assessing differences in intake between sub-groups of the population.

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