

Nutrition and dental health



Guidelines for professionals

Revised 2008



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Why you should read these guidelines

Selecting and offering the advice most appropriate to the age and nutritional needs of client groups is ultimately the responsibility of you, the professional.

This document aims to support you in that role by providing you with current, agreed nutritional guidance relating to the promotion of dental health.

These guidelines are evidence-based, support best practice for the promotion of dental health and are reasonable, realistic and practical. They are also consistent with general nutrition recommendations within the wider context of overall health.^{1–9}

Reading these guidelines will help you to:

- review and understand the scientific basis for the relationship between:
 - dental caries and total sugar consumption;
 - dental caries and the frequency of sugar consumption;
 - dental erosion and diet;
- identify and clarify potential conflicts between dental and nutritional health messages;
- understand nutrition-related dental problems of the pre-school

children, schoolchildren, adolescents, adults and older people population groups.

Appendices 1–9 include a number of valuable reference resources for all those involved in the promotion of dental and general health.

Perhaps the most important of these is appendix 5 which outlines suggestions for between-meals snacks and drinks. However owing to varying nutritional requirements at different life stages, it is not possible to develop a definitive snack and drink list suitable for all age groups. It is essential that consideration is given to the nutritional needs of the person for whom the advice is being provided. For example, because of their high energy needs and small appetites, young children may require three nutritious snacks in addition to three meals each day. Similarly frail elderly people may require more nutritious between-meal snacks than simply fruit, water or milk.

Guidelines for professionals: a rationale

Dental decay continues to be a significant public health problem in Northern Ireland, for children in particular. The last comparative study of the dental health of children in England, Scotland, Wales and Northern Ireland showed that 61% of five year olds in Northern Ireland had obvious signs of decay experience, compared with the UK average of 43% for this age group.¹⁰

Northern Ireland has the highest levels in Europe of general anaesthetics for dental reasons. In 2003 almost 8,000 children attended hospital to have dental treatment under general anaesthetic. The cost of fixing the decayed teeth of our children was over £25 million in 2003.¹¹

Dental caries has been found to be associated with social deprivation, and levels of the disease are higher in socially deprived areas and lower in more affluent areas. The main cause of tooth decay is related to the frequency and amount of sugars consumed in both foods and drinks.¹ Peak activity of dental caries occurs during childhood.

Poor diet also contributes to other health problems common in Northern Ireland, including

heart disease, cancer and obesity. For example, in 2003, one in five boys and one in four girls in Year 1 at primary school were overweight or obese¹². In 2007 over 60% of adults were either overweight or obese.¹³ Moynihan proposed that oral health should not be viewed in isolation from general health and that the type of diet that protects against major conditions such as obesity, cardiovascular disease and cancer will also protect against dental caries.¹⁴ By adopting this 'common risk factor approach' we can therefore help to improve not only the dental but also the general health of the population.

One of the major problems in providing nutritional advice relating to health is that for the prevention of specific conditions particular aspects of the diet are emphasised, often to the exclusion of other important elements essential for overall health. For example, for dental health the intake of sugar-containing foods and drinks is emphasised, whereas the importance of reducing fat and salt may be overlooked thus missing the opportunity to promote a more holistic message.^{1-3,14}

Overall dietary goals promote an increased intake of wholegrain foods, fruits and vegetables and a reduced consumption of 'free' (or non-milk extrinsic) sugars*, fat and salt.^{2,3,15-17} It is very important therefore for health and other professionals to be clear about what exactly they are encouraging people to do. In the ideal situation, realistic and achievable goals for healthy eating should be negotiated with individuals, based on their existing behaviour.¹⁸ Where possible, it is also desirable to create healthy environments that help to make it easier for people to make the healthier choices.

The most important dietary factors in relation to dental health are the amount and the frequency with which sugar-containing foods and drinks are consumed. From a practical point of view, limiting frequency generally reduces total sugar intake. When sugars are consumed they should therefore be taken as part of a meal rather than between meals.¹ The consumption of snacks or drinks containing sugar at bedtime

should also be discouraged, owing to the difficulty of ensuring the removal of all traces of sugars by tooth brushing and because salivary flow is greatly reduced during sleep.

Approximately three quarters of total sugars in the diet are those that are added during manufacture, cooking or at the table.¹ According to the findings of the National Diet and Nutrition Surveys for children and adults, the main sources of free sugars in the diet (ie sugars added by the manufacturer and by the consumer, plus sugars present in juices, syrups and honey) were soft drinks, sugar, preserves and confectionery, especially chocolate confectionery.^{19,20} This was reinforced by Moynihan and by Watt and McGlone who also highlighted the significance of biscuits and cakes as a major source of free sugar.^{14,18} These foods, generally consumed between meals, should therefore be the main focus when advising clients to cut down on added sugars.¹

*For ease of reading within this document 'non-milk extrinsic sugars' will be referred to as 'free' sugars. Although lactose is an extrinsic sugar ie free sugar, when naturally present in milk it is considered to be virtually non-cariogenic and for the purposes of this document is not regarded as a free sugar.

One of the purposes of this document, which was originally produced in 1993, is to help to dispel some of the conflicting advice on diet and dental health being given to the public by various health professionals. The increasing number of joint health promotion initiatives such as health fairs has resulted in a wide range of health professionals working together, and, on occasion, providing conflicting advice and information. Advice given by all health professionals should of course be complementary, treating the client as a whole person and not dealing with one part of the body in isolation from the rest.

The need for this third revision testifies to the value placed on the original by a broad range of health professionals, teachers and students. The 2008 revision takes account of current approaches and health promotion initiatives and also incorporates the common risk factor approach.

The recent increase in the prevalence of childhood obesity is causing considerable concern and highlights the value of the common risk factor approach and also the need for

multidisciplinary working.^{2,11,12}

The concern has resulted in a number of health promotion activities in various settings, including initiatives such as healthy breaks awards, water in schools, nutritional standards for school meals and whole school food health policies.

The basic advice permeating these and other programmes regarding the prevention of dental disease has remained consistent over many years, although, as with all scientific understanding, it has been developed and refined as further research has been conducted. In this context a few of the references in this document may appear to be quite dated, including for example, the 1989 *Dietary sugars and human disease* report and the 1991 report, *Dietary reference values*, both from the Committee on Medical Aspects of Food and Nutrition Policy (COMA).^{3,21} However these reports have never been superseded; they remain the accepted guidance for current practice.

Current practice also emphasises 'The eatwell plate' model.⁴ Formerly known as the 'Balance of good health', this Food Standards Agency

(FSA) education resource is a practical tool that helps people understand and enjoy healthy eating. It shows the types and proportions of foods needed to make up a well-balanced diet that promotes good health and protects against the common diet-related diseases including heart disease, some cancers, obesity and tooth decay.

The eatwell plate applies to children over five, young people, adults, vegetarians and to people of all ethnic origins.

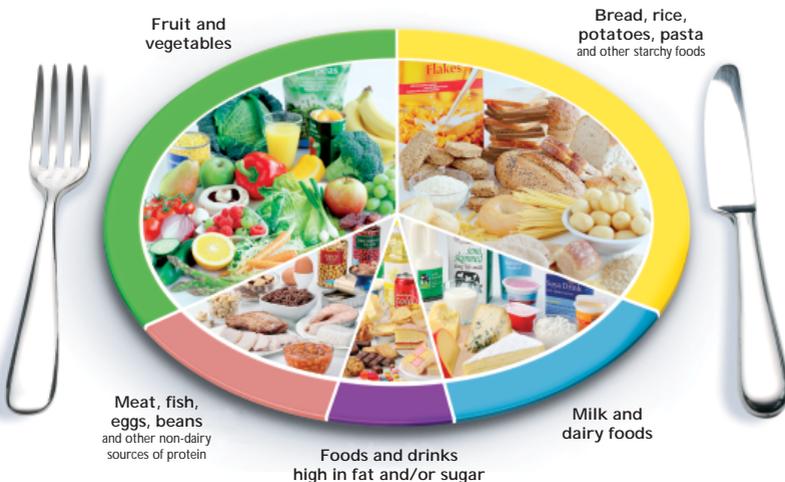
It is not an appropriate education tool to advise on the nutritional needs of babies, children under five, frail older people and people who are seriously ill.

The eatwell plate is widely acknowledged and recommended for use in a variety of settings by a range of professionals promoting good nutrition for overall health. This document is reflective of that model.

The eatwell plate model is based on five food groups.

The eatwell plate

Use the eatwell plate to help you get the balance right. It shows how much of what you eat should come from each food group.



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For a balanced diet it is recommended that people should eat a variety of foods every day from the four main food groups:

- Bread, rice, potatoes, pasta and other starchy foods
- Fruit and vegetables
- Milk and dairy foods
- Meat, fish, eggs, beans and other non-dairy sources of protein.

These provide the wide range of nutrients that the body needs to remain healthy, function properly and help prevent illness.

Foods in the fifth food group add extra choice and enjoyment to the diet but they should not replace foods from the four main groups:

- Foods and drinks high in fat and sugar.

They should form the smallest part of the overall diet. Snacks as well as meals count towards achieving the healthy balance.

Introduction

In the UK it has been estimated that approximately 79g (nearly 16 teaspoonfuls) of free sugars are consumed by men and 51g (10 teaspoonfuls) by women every day, of which sucrose contributes approximately 36kg per year.²⁰ For young people the figure is 85g for boys (17 teaspoons) and 69g for girls (nearly 14 teaspoons), which equates to 17% of total energy intake. Soft drinks and confectionery have been found to be the main source of free sugars in the diets of young people.¹⁹

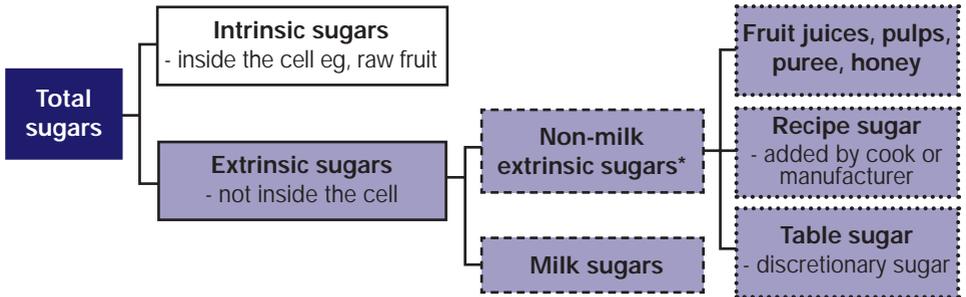
Local eating habit surveys of young people and adults in Northern Ireland indicate that sugar-containing products such as biscuits, soft drinks and confectionery feature regularly in their diet.^{22,23} Another study, comparing the snacking behaviour of adolescents in Belfast and Helsinki showed that significantly larger proportions of Belfast's young people consumed cariogenic snacks like chocolate, confectionery and carbonated drinks on a daily basis, while the Helsinki adolescents had much healthier snacking regimes.²⁴

Moynihan pointed out that over the past 20 years the contribution of soft drinks, biscuits, cakes and breakfast cereals to total sugar intakes has increased significantly. For example during the period 1980 to 2000 the contribution of soft drinks to total sugars intake more than doubled from a level of 15% up to 37%.¹⁴

The result of this marked rise in the consumption of sugars was and is reflected in the high incidence of dental caries in Northern Ireland, particularly in areas of high social deprivation.^{10,25} The frequent and high intake of free sugars is considered to be a major contributor to the development of dental caries.^{1-3,14,18}

A reduction in the intake of free sugars will not only contribute to an improvement in dental health but will have other health benefits, notably in helping to prevent and manage obesity. Figure 1 details the classification of total sugars, including non-milk extrinsic (free) sugars.²⁶

Figure 1: Classification of dietary sugars
(figure adapted from Black, 1991)



*For the purpose of this document non-milk extrinsic sugars are referred to as 'free' sugars.

A report on dietary sugars and human disease by COMA made the following recommendations that still stand today³:

- The consumption of free sugars by the population should be decreased, and replaced by fresh fruit, vegetables and starchy foods.
- Those providing food for families and communities should seek to reduce the frequency with which sugary snacks are consumed.
- For infants and young children, simple sugars (glucose, fructose, sucrose) should not be added to bottle feeds; sugared drinks should not be given in feeders where they may be in contact with the teeth for prolonged periods; dummies or comforters should not be dipped into sugars or sugary drinks.

- Schools should promote healthy eating patterns both by nutrition education and by providing and encouraging sound food choices.
- Elderly people with teeth should restrict the amount and frequency of consumption of free sugars because their teeth are more likely to decay due to exposure of tooth roots and declining salivary flow.
- When medicines are needed, particularly in the long-term, sugar-free formulations should be selected by parents and medical practitioners.
- The final recommendation considered the advice given to clients by health professionals and called for cooperation between dental health professionals and dietitians.

Watt and McGlone have reinforced the COMA recommendation that free sugars intake should not exceed 10% of the total dietary energy (calorie) intake (including alcohol) nor 11% of the total food energy (excluding alcohol), and that free sugars have been implicated as the main causative factor in dental caries.¹⁸

The scientific evidence states that a frequency of sugar intake not exceeding four times a day is consistent with good dental health.^{1,2,14,18} This should be the recommended goal for the majority of the population.

However research carried out in the 1990s indicated that most children in Northern Ireland have at least six feeding or drinking episodes each day.^{27,28} A more recent study of the snacking behaviour of adolescents in Belfast showed that approximately a quarter of them consumed cariogenic snacks and drinks several times a day.²⁴

While it is recommended that sugar consumption should be limited to four intakes per day (including mealtimes) it may be appropriate to agree a more achievable short-term frequency for these groups (eg six times a day) as a means of facilitating

a transition to the ideal goal. It should also be borne in mind that certain client groups, such as very young children and frail older people, have specific nutritional needs and require additional snacks between meals. This may warrant a more flexible approach and highlights the importance of negotiating goals suited to the needs of the individual.

There are also many social issues relating to food and eating. Rugg-Gunn and Nunn pointed out that eating patterns are closely related to social class, with mothers in social classes IV and V being less likely to breastfeed their babies.²⁹ They are also more likely to add sugar to bottlefeeds and to use feeding bottles more often than those in social classes I and II. In addition, a study of nursery schoolchildren in Edinburgh found that mothers in the more deprived areas of the city were more likely to give their children sweets after school and allow sweet consumption throughout the day than mothers in less deprived areas.²⁹

In relation to working with people to promote dental health, Rugg-Gunn emphasised how essential it is to understand the

many diverse influences that mould eating habits so that we may offer appropriate and acceptable advice and help to motivate people to change their behaviour for the better. As he stated in an earlier publication, still very relevant today:

“We should be aware of these social pressures and our advice will fail if we try to go against the social behaviour of any particular age group. It is often beyond our expertise and resources to reshape a family’s lifestyle. Often the best one can achieve is a substitution of better snacks for (poor) ones. Avoid saying ‘Don’t’. Make advice Positive, Personal and Practical.” ³⁰

The scientific basis of the relationship between dental caries and the consumption of sugars

The scientific evidence relating free sugars to dental caries is conclusive.^{1-3,14,31} Two important issues remain, however. These are (1) determining the 'safe' levels of sugar consumption consistent with good dental health and (2) determining the 'safe' frequency of sugar consumption consistent with good dental health.

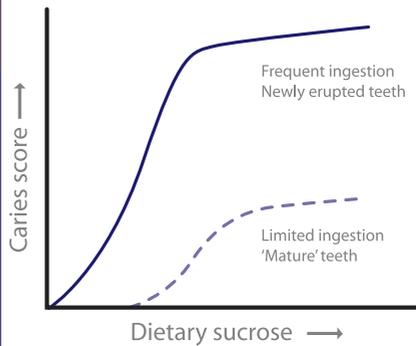
Determining 'safe' levels of sugar consumption

Newbrun has suggested that the dose-response relationship between sugars and dental caries is an S-shaped curve on which low levels of sugar consumption relate to low caries experience and increased consumption relates to an increase in dental caries.³² Highest caries incidence occurs at 38kg per person per year.³³ (Average sugar consumption in the UK is approximately 36kg per person per year.²⁰)

However, the dose-response curve is influenced firstly by the frequency of sugar intake and secondly by the maturity of the dentition (see Figure 2). Both high frequency of sugar consumption

and younger (more recently erupted) teeth are associated with higher levels of caries. What, then, is the 'safe' amount of sugar to consume without compromising dental health?

Figure 2: Proposed relationship between caries score and dietary sucrose intake by humans.³²



Studies during World War II have demonstrated that as sugar consumption fell to 0.2kg per person per year the incidence of dental caries fell. As sugar consumption rose from 0.2 to 20kg per person per year there was an equivalent rise in caries experience, suggesting that safe levels of sugar consumption connected with healthy dentition are identifiable.³⁴

Using other wartime data, Schulerud showed that as Norwegian schoolchildren's sugar consumption fell to 10.4kg per child per year, their dental health improved.³⁵ Shimamura later re-examined this data and found that as the sugar intake rose beyond 10kg per person per year to 21kg per person per year then the rate of dental caries increased rapidly.³⁶

Sheiham, quoting British data, has demonstrated that when total sugar consumption in Jersey was reduced to 8.3kg per person per year 51% of children were caries free.^{31,37} The remaining 49% had an average of 1.8 decayed teeth.

Elsewhere, Sreenby has examined sugar intake using data from the World Health Organization.³⁸ He demonstrated that where sugar intake was low the caries experience of the population was low, indicating that the safe amount of dietary sugar commensurate with dental health was within a range of 0.2kg per person per year and 16 to 18kg per person per year.³⁸

Sheiham has reviewed the appropriate literature on safe levels of sugar consumption and has demonstrated the importance of the presence of

fluoride.^{31,37} He showed that where fluoride was present in any form the dose-response curve shifted to the right, reducing the caries score and meaning that an individual could 'safely' consume a 'dosage' of 15kg of sugar per year. However where no fluoride was used then a person could 'safely' consume only 10kg of sugar per year, so supporting the earlier work of Shimamura.³⁶

More recently, the COMA Panel on Dietary Reference Values has recommended that total sugar intake should not exceed 10% of total dietary energy (where alcohol is included) nor 11% of total food energy (excluding alcohol), and this is consistent with Sheiham's findings.²¹ However it must be noted that at this level of sugar consumption the frequency of intake remains a critical factor in the incidence of dental caries.

Determining the 'safe' frequency of sugar consumption

Cognisant of the trend towards frequent snacking of soft drinks, cakes and confectionery, COMA has recognised the importance of the relationship between frequency of sugar intake and dental caries.^{3,21}

The relationship between dental caries and frequent ingestion of soft drinks has been examined.³⁹ The findings show that frequent consumption of soft drinks was significantly associated with high caries rates.

Another study demonstrates that caries experience was significantly related to the frequency of consumption of confectionery, cakes and biscuits.⁴⁰ The relationship between the frequent consumption of free sugars and dental caries has also been confirmed.^{32,41} These studies show that a high frequency of dietary sugars pushes the dose-response curve to the left, meaning that smaller but more frequent 'doses' of sugar are associated with high caries experience. Sheiham states that when sugar is eaten four or fewer times per day the dose-response curve moves to the right and rises less steeply.³⁷

As noted earlier, the scientific evidence indicates that a safe frequency of sugar consumption associated with a healthy dentition, is four times daily, including sugars taken at meal times. This should be the recommended goal for the majority of the population.

At present in Northern Ireland the frequency of consumption significantly exceeds this ideal and certain client groups have specific nutritional needs. These issues highlight the need for a more flexible approach and the importance of negotiating goals suited to the needs of the individual.

Milk and cheese have been shown to be protective against demineralisation of tooth enamel. Cheese in particular has been found to stimulate salivary flow and raise plaque calcium levels to promote remineralisation.²⁹ In practice this need only be a small cube of cheese taken at the end of a meal. Chewing sugar-free gum may also help by stimulating salivary flow and reducing acidity in the mouth.^{1,42}

To further support these dietary recommendations for the promotion of dental health, twice daily tooth brushing with a fluoride toothpaste should be widely encouraged.¹

Recommendations

The following are based on current dietary recommendations which stress that both safe levels of total sugar intake and the frequency of sugar ingestion

must be considered if dental caries is to be prevented.^{1-3,14}

- Free sugars intake should not exceed 10% of the total dietary energy intake (including alcohol) nor 11% of the total food energy (excluding alcohol). This is equivalent to 11 teaspoons of sugar per day for a woman, 14 teaspoons per day for a man and between 10 and 12 teaspoons for children aged between 7 and 14 (see Appendix 1).
- Even if fluoride is present in any form, for overall health, total sugar intake should not exceed 11% of total food intake.
- A safe frequency of consumption of free sugars that would help ensure a healthy dentition would be four times daily, including sugars taken at meal times. This is the accepted ideal target for dental health. For people with a high sugar frequency, it may be necessary to negotiate an achievable and acceptable interim target. Advice should be based on the needs of the individual (see Appendix 5 for suggestions for between-meal snacks and drinks).

The scientific basis of the relationship between dental erosion and diet

Dental erosion has been described as: “the irreversible loss of dental hard tissues by a chemical process not involving bacteria; this differentiates it from [dental] caries”.⁷

Erosion is classed as a type of tooth wear, which, if allowed to progress, results in sensitivity to hot, cold and acidic drinks or foods. In extreme cases it can cause persistent pain and discomfort.¹

The aetiology of dental erosion is said to be multifactorial. This means it is recognised that intrinsic factors (tooth resistance, saliva, anatomy of

the mouth, gastro-oesophageal reflux and medical conditions) and extrinsic factors (diet, lifestyle, medication and environment) may all act to increase an individual’s susceptibility to dental erosion (see Figure 3).

It has been well established that all acids (both intrinsic and extrinsic) have the potential to cause dental erosion through the process of enamel demineralisation.⁷⁻⁹ However, in the context of this document, causes of erosion will be restricted to the dietary aspects of the aetiology.

Figure 3: Multifactorial aetiology of dental erosion⁷

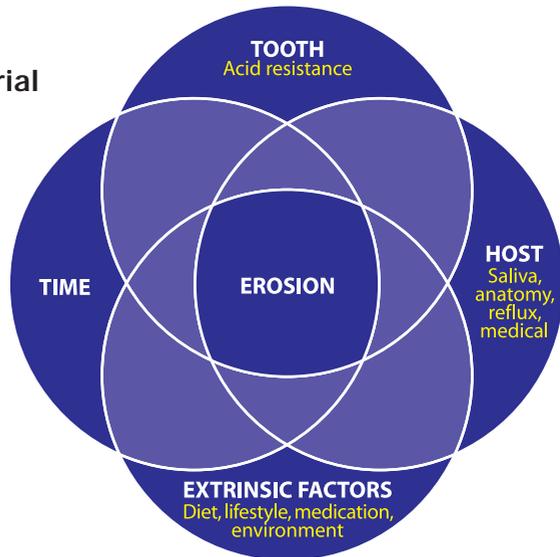


Figure 4: Comparison of percentages of children and adolescents with tooth surface loss between 1993 and 2003⁴³

	5 year olds		8 year olds		15 year olds	
	1993	2003	1993	2003	1993	2003
Incisors						
Buccal surfaces (front surface of teeth)	18	20	4	4	12	20
Molars						
First permanent	-	-	n/a*	10	n/a*	22

*No assessment of tooth surface loss made in 1993

Research suggests that the prevalence of dental erosion in children and adolescents may have increased in the last 10 years. In the UK there has been an increase in the proportion of children and adolescents experiencing tooth surface loss (an indicator of dental erosion) between 1993 and 2003.⁴³

In Ireland in 2002, 45% of a sample of five year olds showed evidence of erosion.⁴⁴ It has been suggested that there could be a link between dental erosion and the increased consumption of acidic soft drinks, including carbonated drinks, fruit juices, diet drinks, sports drinks and alcopops identified among children and adolescents.^{45,46}

While acknowledging the need for greater research in this area, the evidence of increased consumption of these drinks in children and adolescents over the years has provided the background for an argument to support this point of view (Figure 5).

Infants, toddlers and dental erosion

The issue of erosion is important in early childhood because of the thinner dental enamel and its greater acid solubility. In infancy, erosion of the dentition is associated with the use of fruit drinks taken in feeding bottles. For toddlers, erosion has been linked to the frequent consumption of carbonated (fizzy) drinks and insufficiently diluted fruit juices

Figure 5: UK soft drinks consumption, 1986 – 2006

(Source: British Soft Drinks Association 2006)⁴⁷

000 million drinks

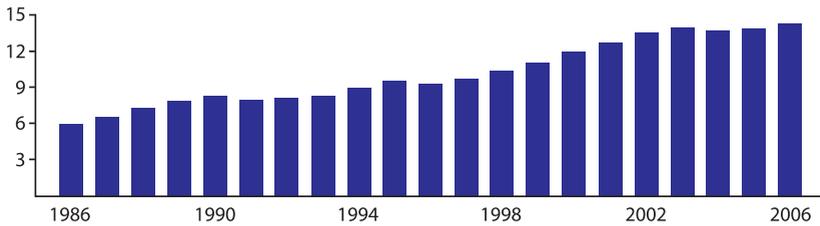
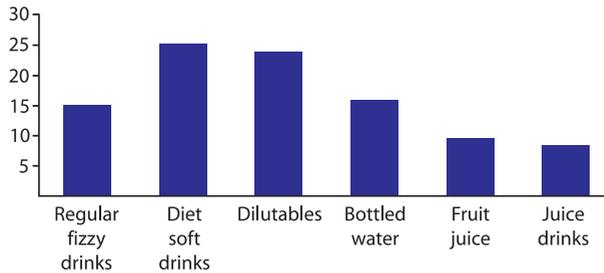


Figure 6: UK soft drinks by volume

(Source: British Soft Drinks Association 2006)⁴⁷

% of market share



and squashes.⁷ This helps to reinforce the advice that milk and water are the preferred choice of drinks for young children, particularly between meals.

Children, adolescents, adults and dental erosion

In recent years there have been significant changes in the dietary patterns of children and adolescents. This has included an increase in 'grazing', snacking

and the consumption of soft drinks, including diet drinks. Soft drinks manufacturers have targeted young people, encouraging them to consume more carbonated drinks, including diet drinks that have a high acidic content. It would seem reasonable to suggest that the frequent consumption of these drinks has contributed to an increased prevalence of dental erosion in adolescents.

The introduction of sports drinks, which are often perceived as 'healthy', can also present a potential problem. These drinks, which have a high acid content, are often consumed after physical exercise when the mouth is dry.^{7,48} As a result they have a greater erosive potential, as the buffering effect of the saliva is reduced. A similar situation occurs at night when acidic drinks such as fruit juices, squashes and carbonated drinks are taken prior to bedtime. The reduced salivary flow experienced while sleeping means that the erosive potential of these drinks is greater.²⁹

The popularity of 'alcopops' among under 18s has introduced another potential problem because of the acidity of these drinks. In the UK it was projected that sales of alcopops would more than double in the five years from 2002 to 2007 to almost £4,000 million.⁴⁹ Studies have shown that these drinks have an erosive effect on the dental enamel as a result of their low pH (<4).⁴⁶

An additional problem associated with dental erosion is linked to oral hygiene practices. These include the brushing of teeth immediately after drinking acidic drinks, when demineralisation of the dental enamel will have occurred, making it more susceptible to abrasion.

Also, the use of some acidic proprietary mouthwashes and saliva substitutes can contribute to dental erosion. There is a consensus of professional opinion that tooth brushing should be delayed for up to one hour after consumption of acidic drinks and that a low abrasion, high fluoride toothpaste should be used. The use of fluoride mouthwashes or the topical application of fluoride varnishes or gels may also be recommended, particularly for those who have sensitive teeth as a result of erosion.^{1,29,50}

The temperature and method of drinking acidic drinks is considered to influence their erosive potential. It has been suggested that they should be taken ice-cold to reduce their erosive effect; they should not be sipped slowly or swished around the mouth; and, they should be taken through a straw to reduce contact with the teeth.^{1,29,50}

In addition it is thought that taking milk or cheese after acidic foods or drinks may be beneficial.^{1,29}

However, until further research is carried out much of the advice currently given relating to the prevention of dental erosion is based more on common sense than evidence based practice.^{1,29}

Recommendations

- Infants should not be put to bed with a feeding bottle.*
- Children should be introduced to drinking from a cup from six months onwards and from one year feeding from a bottle should be discouraged.*
- If fruit juices are given to children over six months they should be unsweetened, well diluted (one part juice to 10 parts water) and given in a feeding cup, ideally at mealtimes rather than between meals.*
- The frequency of acidic drinks such as fruit juices, squashes and carbonated drinks (including diet and sports drinks) should be reduced. They should be limited to mealtimes, where possible, rather than between meals, and avoided at bedtime.
- Between meals the safest drinks are plain water, milk, tea and coffee (without sugar).**
- It may be beneficial to finish a meal with a small cube of cheese (approximately 5g – about the size of a small sugar cube) or a drink of milk.
- The risk of dental erosion may be reduced by drinking acidic drinks through a narrow straw placed behind the front teeth and well to the back of the

mouth. Acidic drinks should be taken chilled and not swished around the mouth.

- Avoid sugary or acid drinks or foods close to bedtime.
- Avoid brushing teeth for about an hour after consuming acidic drinks. Use a small amount of a less abrasive toothpaste (ie a gel-type paste) and use a fluoride mouthwash.
- Professional application of fluoride varnishes and gels can give added benefit by increasing the acid resistance of enamel and reducing sensitivity.

*See recommendations for pre-school children in section on nutrition-related dental problems (pages 32-37).

**Tea and coffee are unsuitable for infants and young children as they contain caffeine and tannins (tannins reduce the absorption of essential nutrients, eg iron).

Clarification of dental and nutritional health education messages

The aim of this section is to clarify previously conflicting dental and nutritional health messages.

Milk and dairy foods

The sugar content of milk and milk products

In 1989 COMA stated that “although lactose alone is moderately cariogenic, milk also contains factors which protect against dental caries, so milk without added sugars may be considered to be virtually non-cariogenic”.³ This view is restated in recent publications.^{1,2}

Flavoured yogurts and fromage frais

These tend to contain quite a lot of sugar and are therefore best taken at mealtimes. Natural yogurt or plain fromage frais (with added fresh fruit if desired) are preferable for between-meal snacks. Diet milk products such as diet or low calorie yogurt are not intended for use by babies or toddlers. Where possible plain whole milk products (rather than low-fat varieties) should be used from six months until two years of age, when lower-fat varieties can be gradually introduced,

providing the child is eating a varied diet and has satisfactory growth.

Cheese

Cheese has been found to protect the teeth through neutralising dietary acids, by stimulating the flow of saliva in the mouth, and increasing plaque calcium concentration. This can be achieved with a small piece of cheese (approximately 5g (1/5oz) – about the size of a small sugar cube) without significantly increasing dietary fat intake.⁴⁵

Recommendations^{5,6,51,52}

- Breastmilk is the best form of nutrition for infants; it provides all the nutrients and fluids a baby needs. Exclusive breastfeeding is recommended for the first six months of an infant's life. After solid foods are introduced, breastfeeding mothers should be encouraged and supported to continue to breastfeed until the end of the first year of life and beyond.
- An infant who is not breastfed should receive infant formula milk.

- Follow-on milk is not recommended before six months and is not necessary for the majority of infants.
- Plain cow's milk is considered to be non-cariogenic and is recommended as a safe drink between meals.
- Cow's milk is not suitable for children under one year. From one to two years whole milk should be used. Semi-skimmed milk may be given from two years providing the child is eating a balanced and varied diet. Fully skimmed milk should not be given to children under five years of age.
- Natural yogurt or plain fromage frais (with added fresh fruit if desired) are suitable between-meal snacks.
- A small piece of cheese (approximately 5g – about the size of a small sugar cube) taken at the end of a meal will help to protect the teeth.

Research has shown that fruit and vegetables, which contain vitamins, fibre and other substances, can help protect against major illnesses such as certain cancers and heart disease. The current recommendation for consumption equates to at least five portions of fruit and vegetables daily, including fresh, frozen, canned, dried and juiced varieties.^{2,4} Potatoes are not included as they are classified as starchy carbohydrates rather than vegetables (a guide to what constitutes a portion of fruit or vegetables can be found in Appendix 6).

In Northern Ireland only about 21% of adults eat five or more portions of fruit and vegetables a day, while approximately 11% reportedly do not eat any fruit or vegetables on a daily basis. Around 14% eat one portion a day.²³ In relation to children and young people, only about 11% are reported to achieve the recommended target of five portions of fruit and vegetable a day.²²

Baked beans, although also classified under 'Meat, fish, eggs, beans and other non dairy sources of protein', can count as one of the five portions a day.

Fruit and vegetables

The sugar content of fruit and vegetables

COMA has stated that fresh fruit (and vegetables) appears to be of low cariogenicity and hence not a major contributor to dental caries.³

Some varieties of baked beans contain sucrose therefore they are best eaten at meal times. Sugar-free varieties are available but are often more expensive and not generally necessary if taken at mealtimes.

Dried fruit has a high concentration of sugars and it is thought that frequent consumption, particularly between meals, could increase the risk of dental decay.¹ It should be noted that while dried fruit is not regarded as a suitable between meals snack it can safely count as one of the recommended five portions of fruit and vegetables a day if taken at mealtimes.

The excessive consumption of citrus fruits and fruit juices has long been implicated in erosion of the teeth.⁵³⁻⁵⁵ This is generally in very extreme cases, or where specific patterns of consumption have been observed, such as the sucking of oranges or lemons over prolonged periods of time.^{53,54} For example, in one case a patient was found to be drinking a glass of fresh orange juice, equivalent to the juice of six oranges, three times a day with her meals.⁵³ In another case hot lemon juice was taken on retiring every night in the belief

that it would induce weight reduction.⁵⁴

In light of these findings it has been suggested that, particularly for young children, citrus fruit juices should be well diluted prior to consumption and should ideally be limited to mealtimes.⁵⁶

Pure fruit juice can only be counted as one of the five portions of fruit or vegetables per day, even if more than one glass is consumed. A variety of fruit and vegetables should be eaten to meet the 'five a day' target.^{57,58}

Recommendations

- The consumption of fruit and vegetables should be encouraged. At least five portions of fruit and vegetables should be taken daily. (Note that fruit juice and baked beans can each only be counted as one of the five portions, even if more than this is consumed).
- As some varieties of baked beans contain sucrose it is recommended that they be eaten at meal times.
- Reduction of free sugars can be achieved by replacing them with fruit and vegetables.
- Fresh fruit and vegetables make ideal, healthy, between-meal snacks.

- Dried fruit and pure fruit juices are not recommended as suitable between-meal snacks/drinks and are best taken at mealtimes.
- For infants over six months and young children, pure fruit juices should ideally be diluted prior to consumption (one part juice to 10 parts water), and where possible taken at meal times. They should not be taken at bedtime.
- The excessive frequent consumption of citrus fruits and pure fruit juices should be avoided to prevent erosion of teeth.
- Avoid brushing the teeth for up to an hour after taking acidic foods or drinks.

Bread, rice, potatoes, pasta and other starchy foods

Cariogenicity of starchy foods

Cooked starch or starchy foods, eg bread, pasta, rice and potatoes, have been demonstrated to be virtually non-cariogenic. However, combinations of cooked starch and sucrose, eg cakes and biscuits, are very cariogenic.³⁰ (These are considered 'Foods and drinks high in fat and sugar, see the next column).

Recommendations

- The consumption of starchy foods such as bread, potatoes, pasta and rice should be encouraged and included as part of every meal. Choose high fibre varieties where possible and use healthy cooking practices.
- Bread-based products are recommended as suitable snacks between meals.

Foods and drinks high in fat and sugar

All biscuits, even plain varieties, contain sugar. They are therefore not recommended as a between-meals snack. However, provided they are not consumed frequently, and where possible limited to mealtimes, plain biscuits are nutritionally preferable to, for example, chocolate coated or cream-filled biscuits which have a higher sugar and fat content.

In the past crisps tended to be promoted as a safe snack. However, as crisps have a relatively high fat and salt content (even the low- or reduced-fat varieties) and many contain sugar they are not recommended as a healthy snack.

While nuts are actually classified under 'Meat, fish, eggs, beans and other non-dairy sources of protein', for convenience they are included here alongside crisps and other savoury snacks. Nuts do not present a threat to dental health. However nuts have a relatively high fat content and are often coated in salt, so cannot be freely recommended. Note that whole nuts are not suitable for children under five years because of the risk of choking.^{5,6,52,56}

Recommendations

- Nuts and crisps should not be promoted as an ideal snack choice for individuals. If used, low- or reduced-fat crisps and unsalted nut types should be consumed.
- Examples of the best snack choices include fruit, vegetables and bread thinly spread with margarines labelled high in polyunsaturates or monounsaturates, low-fat spread or butter. Further suggestions are provided in 'Suggestions for between-meals snacks and drinks' (Appendix 5).

Medicines and oral health

Many medicines can have a variety of different negative effects on oral health. The following information relates to some of the most commonly occurring oral health problems related to the use of medicines.

The sugar content of medicines

Medicines containing sucrose are cariogenic, and where possible sugar-free alternatives should be suggested. In describing the content of sucrose in liquid medicines, especially 'over the counter' preparations, Mitchell demonstrated that of 226 products examined 155 contained between 15% and 90% sucrose.⁵⁹

The number of sugar-free alternatives for both prescription and over the counter medicines is now quite extensive and constantly increasing. A list of the range of therapeutic categories for which sugar-free alternatives are available can be found in Appendix 8. If a sugar-free alternative is not available, medicines should ideally be given at mealtimes, if permitted, but not at bedtime.

Dry mouth

Without the cleansing effects of saliva, tooth decay and other oral health problems become more common. Many medicines including antihistamines, antidepressants etc may have this effect.⁶⁰

Medicines used for the treatment of asthma

Medicines taken by inhalation may cause dry mouth and inhaled steroids increase the incidence of oral fungal infections such as candidiasis. The use of a spacer device may help reduce these symptoms and people with asthma should be advised to rinse their mouth with water after using their inhaler.⁶⁰

Miscellaneous

Other medicines may adversely affect oral health, for example calcium channel blockers used in the treatment of cardiovascular disease, and some anticonvulsants used in the treatment of epilepsy may cause gingival (gum) hyperplasia. Medicines such as oral contraceptives may cause inflammation of the gums while some antidepressants, as well as causing dry mouth, may cause taste disturbances.⁶⁰

For further information on the effects of individual medicines patients or clients should be advised to speak to their local community pharmacist.

Recommendations

- Many drug companies have sugar-free alternative medicines. Health professionals should always check if a medicine contains sucrose and prescribe or offer sugar-free alternatives wherever possible.
- The use of sugar-free medicines is of importance for children, adults and other persons on long-term or frequent medication or both.
- When being given a prescription, people should be encouraged to ask the prescriber (eg doctor, dentist, pharmacist etc) for sugar-free varieties of all medicines.
- People should be encouraged to ask pharmacies for sugar-free medicines when they are purchasing an over the counter product.
- Where no sugar-free alternative exists, tablets rather than syrup should be recommended where appropriate. It is important to stress that tablets should be swallowed promptly and

not held in the mouth. If liquid medicine is necessary, eg for young children, it should ideally be given at mealtimes and not at bedtime.

- Chewing sugar-free gum may help to stimulate salivary flow and alleviate the problem of dry mouth which can be a side effect of certain forms of medication.
- To reduce the risk of oral fungal infections when taking inhaled steroids, the use of a spacer device should be recommended and patients should be advised to rinse their mouth with water after using their inhaler.

Nutritional labelling

At present, there is no legal requirement for food companies to provide information about the nutritional composition of their products unless they make a nutritional claim. Nutritional labelling is essentially voluntary practice.

Of those companies who do declare nutritional information, it usually takes the form of a table that shows the amount of energy, protein, carbohydrate and fat per 100g of product and sometimes also per serving or pack (for guidance

on interpreting the nutritional information on food labels see Appendix 7).

On products where no nutritional information is provided the sugar content of a product may be assessed by looking at the list of ingredients. The higher on the list sugar appears, the more there is in the product. On ingredient lists sugar appears in many different forms, for example glucose, dextrose, maltose, honey, fructose, glucose syrup, molasses, treacle, invert sugar, maltodextrins and maple syrup. Brown sugar is as cariogenic as white.

The FSA has agreed 'signposting' recommendations to ensure a consistent approach to front of pack labelling that will provide 'at a glance' information on labels about the nutritional content of foods⁶¹. FSA recommendations are based on four core principles. Front of pack labelling schemes should:

- Provide separate information on fat, saturated fat, sugar and salt.
- Use red, amber or green colour coding to indicate whether levels of these nutrients are high, medium or low.
- Use nutritional criteria developed by the FSA to determine the colour code.

- Give information on the levels of nutrients per portion of the product.

Some supermarkets are starting to use the FSA recommendations. Further information is available on the FSA website www.food.gov.uk/foodlabelling/signposting

Some companies within the food industry have developed an alternative labelling scheme known as 'guideline daily amounts' (GDAs). It should be noted that these are not approved by the FSA and in fact the GDA for sugars for men is double the daily intake for free sugars recommended by COMA.²¹

Nutritional claims

A number of nutritional claims can be found on food labels such as 'sugar-free', 'reduced sugar' 'low sugar' and 'no added sugar'. This can be confusing for the consumer when food contains alternative forms of sugar such as fructose or glucose which are also damaging to teeth.

The problem can be further compounded if the food manufacturers highlight the desirable features of the food without referring to the negative

aspects, such as when sugar-based confectionery is sold as low-fat.⁶¹ Products such as biscuits and cakes sold as low in fat are often higher in sugar than standard varieties. For further information on how to interpret quantities of sugar, fat and salt on food labels see Appendix 7.

Further information is also available on the FSA website www.food.gov.uk and in the FSA leaflet entitled *Labelling claims*.

Recommendations

- Health professionals should provide advice to clients on how to read and interpret the sugar content of products and be aware of the hidden forms of sugar.
- Health professionals should assist clients to read and interpret additional key nutrition information such as the fat (especially saturated fat) and energy content of food products.
- Health professionals should raise clients' awareness of why nutritional claims on food labels can be misleading, ambiguous and selective.
- The food industry should be encouraged to include information relating to total free sugars in an understandable way on nutritional labelling.

- Efforts should be made to encourage the creation of legislation that makes nutritional information provision compulsory.

Diabetic products

Products sold as suitable for people with diabetes are considered unnecessary and expensive. They are not recommended for people with diabetes or for anybody else. These products are often high in fat and there is no evidence that such foods or drinks offer any advantage to people with diabetes when compared with conventional products.^{62,63}

These products, eg chocolate and biscuits, are often sweetened with sorbitol or fructose instead of sugar and contain as many calories as standard varieties. Sorbitol also has a laxative effect and may cause diarrhoea.

Full guidance on the nutritional management of diabetes is beyond the scope of this document. However people with diabetes should be given detailed dietary advice compatible with good dental health by a registered dietitian.

Recommendations

- Diabetic products are not recommended as they are unnecessary, expensive, may cause diarrhoea and offer no benefits over ordinary foods.
- Dietary advice for people with diabetes is the same as general healthy eating advice – ie a diet low in fat and sugar and high in fruit, vegetables and fibre-rich starchy carbohydrates.
- Calorie free or low calorie products may be used (for example artificial sweeteners such as saccharine, Hermesetas Gold, Canderel, NutraSweet) as well as low calorie drinks.
- People with diabetes should receive appropriate, individualised nutritional advice conducive to good dental health from a registered dietitian to enable them to manage and control their diabetes.

The nutrition related dental problems of pre-school children, schoolchildren and adolescents, adults and older people

COMA³ has stated that “dental caries can occur at any age”. However, due to changing patterns of health behaviours throughout the lifespan, the disease is more prevalent in pre-school children, schoolchildren and adolescents, adults and older persons. The accepted dental health message relating to the consumption of sugar is the same for each age group:

“Reduce the consumption and especially the frequency of intake of drinks, confectionery and foods with sugars”.^{1,3}

Pre-school children

‘Early childhood caries’ previously known as ‘nursing bottle caries’ is found in infants and toddlers who use a feeding bottle over prolonged periods and particularly at night.

Lactose, the sugar naturally occurring in milk, is considered to be relatively non-cariogenic.^{1,3} However, it has been noted that in very rare cases dental caries has been associated with

feeding on demand which was prolonged over several years.²⁹

Some parents or carers may add table sugar or sucrose to bottle feeds. This practice should be discouraged. Early childhood caries is also associated with the prolonged use of sweetened comforters and sugary medicines.

General recommendations

- Sugars should not be added to food or drink given to babies, as this could encourage a sweet tooth and could lead to tooth decay when the first teeth come through.
- Salt should not be added to weaning foods.
- Six months is the recommended age for the introduction of solid foods for both breast and formula-fed infants.
- Honey should not be given to babies under one year old. It can contain a type of bacteria which can cause infant botulism. Honey is also a sugar and can therefore cause tooth decay.

- Parents should be informed about the effects of frequent sugar consumption on their child's dentition.
- Whole nuts of any kind are unsuitable for children under the age of five years because of the risk of choking.
- Peanut products (eg peanut butter) are safe for most children. If there is a family history of conditions such as asthma, eczema or hay fever the Department of Health, Social Services and Public Safety (DHSSPS) recommends that peanut products should be avoided until the age of three.⁶⁴ It should be noted that some brands of peanut butter are high in sugar and therefore not suitable between meals. Parents should be advised to look at the label.
- An infant who is not breastfed should receive infant formula milk until one year of age.
- Solids and sugars should never be added to milk given in a feeding bottle.
- Follow-on milk is not suitable for use before six months and a change to follow-on milk isn't necessary for the majority of infants. It may be useful where there are concerns over the dietary intake of iron. However it should be noted that follow-on milk contains maltodextrins and should not be fed from a bottle.
- Six months is the recommended age for the introduction of solid foods for both breast and formula fed infants.
- Infants should not be put to bed with a feeding bottle. Where this is not possible then plain water should be used (sugar should not be added).

Recommendations: milk

- Breastmilk is the best form of nutrition for infants. It provides all the nutrients and fluids a baby needs. Exclusive breastfeeding is recommended for the first six months of an infant's life. After solid foods are introduced, from six months of age, breastfeeding mothers should be encouraged and supported to continue to breastfeed until the end of the first year of life and beyond.
- From six months of age, infants should be introduced to drinking from a cup and from one year feeding from a bottle should be discouraged. Infants should move on to drinking from a cup without a lid as soon as they are ready. Non-spill, valved cups are not recommended as they encourage longer drinking times, free-flow lidded cups should be used instead so that the baby learns to sip.⁵⁶

- From one year of age a minimum of 350ml (12fl oz) of whole milk is recommended daily to ensure an adequate intake of calcium. Large quantities, eg more than 600ml (1 pint) daily should be discouraged as this will reduce the child's appetite for other foods.
- Semi-skimmed milk is not suitable as a main drink before age two, but thereafter may be introduced gradually if the child is eating a good variety of foods and growth remains satisfactory.
- Skimmed milk should not be given to children under five.
- Soya based infant formulas should not be used as the first line treatment for lactose intolerance or cow's milk protein intolerance, particularly in the first six months of life. More appropriate hydrolysed protein formulae are available and can be prescribed.⁶⁵
- Soya based infant formula should only be used or advised in exceptional circumstances to ensure adequate nutrition, eg for infants of vegan parents who are not breastfeeding, or infants who find alternatives unacceptable. There are concerns relating to possible risks to long-term reproductive health arising from the high

- phytoestrogen content of soya based formulas.
- Soya formula (and other soya products including drinks and desserts) contains free sugars. If used, good weaning practices are important to safeguard dental health. A cup should be introduced at six months and by one year bottlefeeding should be discontinued.
 - Drinks of soya formula between meals or at bedtime are not recommended.
 - Ordinary soya drinks should not be used during weaning. If used for children over one year old particular attention should be given to ensure adequate vitamin and mineral intake.

Recommendations: drinks

- Breastfed babies do not need to drink water, as breastmilk provides all the food and drink required.
- An infant who is not breastfed should receive infant formula milk. However infants fed on formula can get thirsty.
- Thirsty formula fed babies may be given water between feeds (cooled, boiled water for infants under six months). Other drinks are not necessary.
- Parents and carers should be specifically warned against the practice of prolonged drinking

of sugary drinks (including carbonated drinks, fruit based juices and squash and natural fruit juice) from a bottle.

- Infants should be introduced to drinking from a cup (ideally a free-flow lidded cup) at six months and from one year onwards, feeding from a bottle should be discouraged.
- Fruit juices are not necessary, but if given they should be unsweetened, well diluted (one part juice to 10 parts water), given at mealtimes from a cup and not in a bottle or at bedtime.
- Baby juice and herbal drinks are not recommended as they contain sugar, but if used should be well diluted (see above), given from a cup and limited to mealtimes. They should not be given in a bottle or at bedtime.
- Colas, squashes, fizzy drinks and diet drinks are unsuitable for infants as they are acidic and can cause damage to teeth. Diet drinks and sugar-free squashes are also high in artificial sweeteners, which are unsuitable for babies and children.
- Bottled mineral waters (natural or flavoured) and effervescent waters should not be given to infants because of their chemical composition.

- Tea and coffee are not suitable drinks for babies or young children as they contain caffeine. They also contain tannins which may reduce the absorption of some nutrients from food, eg iron.

Recommendations: vitamin supplements

- Up until the age of six months breastfed infants do not need vitamin supplements, provided the mother had an adequate vitamin status during pregnancy. However from six months on supplements of vitamins A, C and D should be given.⁶⁶
- Infants fed on formula milks do not need vitamin supplements provided their intake is more than 500ml (18fl oz) per day, as extra vitamins have already been added to formula.
- Vitamin A, C and D supplements should be given to children between the ages of one and five, unless the child's diet contains plenty of vitamin A, C and D rich foods and the child has moderate exposure to sunlight.
- Vitamin A, C and D supplements should be particularly encouraged for children from traditional Asian or Islamic communities, children born with poor stores of vitamin D, including pre-term babies, and children who are poor eaters.

- Where possible vitamin supplements used should be sugar-free.

Recommendations: moving from milk to family foods

From six months:

- Six months is the recommended age for the introduction of solid foods for both breast and formula fed infants.
- Early introduction of solids is not recommended because the baby's gut and kidneys are not fully matured. If parents still choose to introduce solids earlier than this they should be advised not to do so before 17 weeks. Early weaning requires additional nutrition advice (see the leaflet 'Weaning made easy' available from the Health Promotion Agency for Northern Ireland website: www.healthpromotionagency.org.uk).
- Weaning foods should not contain salt as the kidneys can not deal with it at this age.
- Sugar should be avoided as it could encourage a sweet tooth and lead to tooth decay.
- Honey should be avoided in the first year of life, when the infant gut is still immature, as it can contain the botulinum bacteria.

Suitable first weaning foods include:

- Plain 'baby rice' – mixed with the infant's usual milk (breast or formula).
- Smooth or well mashed cooked vegetables, eg potato, carrot, parsnip, turnip, cauliflower.
- Smooth or well mashed banana, stewed apple, tinned pear or tinned apricots (in natural juice).
- Unsweetened custard.
- Plain or natural yogurt (whole milk based where possible).
- After a couple of weeks the texture can be increased to include a few soft lumps and the variety of foods can be increased.

Between six and nine months:

- The amount, variety and texture of food should be increased, and the number of milk feeds reduced to allow the child to develop a normal eating pattern.
- By seven months food can be mashed with a fork and babies should be having three spoon-feeds a day.
- Infants and young children should always be supervised when eating.

From nine months:

- By nine months the infant can progress to chopped foods and by one year should be eating family meals and drinking from a cup. Feeding from a bottle should be discouraged.
- Rusks and biscuits are not recommended so that babies do not get into the habit of expecting sweet snacks. Even low-sugar rusks contain a significant amount of sugar.
- The majority of the infant's foods should come from family meals. Home prepared foods have many advantages over commercial baby foods, eg they are cheaper and the infant becomes accustomed to family foods.
- If predominantly manufactured foods are given it is important that home prepared foods should also be given to accustom the infant to the greater ranges of flavour and texture they provide.
- Advice on the use of appropriate commercial foods should also be given, eg more use of savoury meals and fruit purees rather than puddings.

From two years:

- The COMA recommendations for the general population

to reduce dietary fat intake do not apply to infants and young children, but they are relevant from the age of five.¹⁵ Between the ages of two and five some lower fat products, eg low-fat yogurt and semi-skimmed milk can be gradually introduced, provided a wide range of food is eaten and growth is normal.

- Children under five should avoid whole nuts. For most children products containing nuts are safe, however where there is a family history of allergy or atopic disease, the DHSSPS recommends that nuts should be completely avoided until the age of three.

(For more detailed advice on infant feeding refer to local infant feeding policies, the leaflets *Weaning made easy* and *Getting a good start – healthy eating from one to five* available from the HPA website www.healthpromotionagency.org.uk and the book *Birth to five* available to first time mothers through their central health promotion resource services.⁵⁶)

Schoolchildren and adolescents

Dental caries in childhood and adolescence remains a significant health problem, along with the increasing prevalence of overweight and obesity.^{2,12} For both age groups, relative independence from family influences and the influence of peers can result in changes in health behaviours and diet, specifically in relation to the intake of sugar, fat and salt, which are commonly found in many snack foods.

Other factors that may affect the eating habits of adolescents include media advertising and the availability of sucrose-containing snacks and drinks either at school (tuck shops and vending machines) or on the journey to, or from, school.

The frequent ingestion of sugary snacks and acidic drinks (including diet and sports drinks) can result in dental caries and dental erosion. These snacks and drinks also add 'empty' calories that may contribute to overweight and obesity. The current movement towards Healthy Schools, the development of nutritional standards for school meals and

other food in schools, as well as initiatives such as healthy snack schemes and the promotion of water and fruit in schools are all helping to tackle these issues.

Recommendations

- The total consumption of free sugars should not exceed 11% of the total food energy per day excluding alcohol (see Appendix 1).²¹
- The ideal target for sugar frequency is four intakes per day, including mealtimes. In some cases, where sugar intake is particularly high, it may be appropriate to agree a more realistic short-term 'interim' frequency (eg, six times a day) as a means of facilitating a transition to the recommended four times a day.
- Children's and adolescents' eating patterns should ideally consist of three regular balanced meals a day but it should be recognised that where they are unable to meet their daily nutritional requirements by eating only at meal times (for example, young children who have a small capacity for food and adolescent boys with very high energy requirements), they will require a snack between each meal.

- The majority of children do not require more than three daily snacks in addition to meals. Recommended snacks between meals for this age group should ideally be sugar-free, low in fat and high in fibre and should take account of the child's usual diet, likes and dislikes.
- Fresh fruit and vegetables make ideal between-meals snacks and make a positive contribution to the recommended five portions of fruit or vegetables per day.
- Dried fruit has a high concentration of sugars and is not regarded as a suitable between-meals snack. However it can safely contribute one of the recommended five portions of fruit and vegetables a day if taken at mealtimes.
- The healthiest choices are listed in the 'Go!' section of the 'Suggestions for between-meals snacks and drinks' (Appendix 5). Often the most that can be achieved is the substitution of better snack and drink choices for poor ones, for example wholemeal or plain scones, low-fat yogurt or a meat sandwich would all be preferable to a bar of chocolate or a packet of sweets.
- If confectionery or sugar-containing foods (eg, a sweet dessert) are eaten, they are best taken at the end of meals.
- Some sugar-free varieties of confectionery are available. They are often more expensive than their ordinary equivalents although less harmful to teeth.
- Sugar-free chewing gums, particularly those containing xylitol, have been found to benefit dental health. It has been suggested that this is due to the chewing action reducing the number of bacteria in the mouth which cause tooth decay and stimulating the salivary flow to counteract the acid which causes tooth decay.^{1,67}
- The drinking of water should be widely promoted. Water and milk are the recommended drink choices, particularly between meals.
- Acidic drinks such as squashes and carbonated drinks, including diet and sports drinks, are not recommended as they contribute to dental decay and erosion (see pages 18–22). They should be limited to mealtimes, where possible, rather than between meals, and avoided at bedtime.

- Although pure fruit juices do not contain added sucrose, they are rich in naturally occurring sugars (fructose, sucrose and glucose) which are free in solution and therefore cariogenic. They are also erosive and ideally should be well diluted and taken at mealtimes only.
- Pure fruit juices can only contribute to one of the recommended five portions of fruit or vegetables per day, even if more than one portion is consumed.^{57,58}
- Participation in health promotion initiatives within school settings, such as Healthy Schools, healthy snack schemes and water in schools, should be encouraged.

The rate of dental caries affecting the crown of the tooth slows down with age as the mature tooth is more resistant to acid attack.³² Eating habits also change in this population group. However the major dental problem of older age is root caries, associated with exposed root surfaces caused by gum recession. Exposed root surfaces are prone to carious attack especially in those with reduced salivary flow. The advice relating to the amount and frequency of sugar consumed and the need to negotiate realistic interim goals is therefore still appropriate for this age group, ie the ideal limitation of sugar intake to four times daily, including meal times.

Adults and older people

The results of the national adult dental health survey have shown that the state of dental health is changing within the adult population and that more people are expected to retain more of their teeth for longer.²⁵ This is advantageous as it will ensure that the ability to chew food is maintained, facilitating the consumption of a healthy diet into old age.

Dry mouth is associated with many prescribed medicines. Over 200 drugs in every day use list dry mouth as a side effect. Many of these drugs are prescribed for older people.⁶⁸ People suffering from reduced salivary flow may try to increase saliva in the mouth by eating sweets or taking frequent cups of tea or coffee. If these contain sugar they further increase the risk of dental decay.

High prevalence of root caries has been associated with high frequency of free sugars intake.

Frequent consumption of plain water should be encouraged and the use of sweetened or acidic drinks limited to mealtimes. It has also been suggested that chewing sugar-free gum may help by stimulating salivary flow and improving the ability of salivary glands to respond to future stimuli.⁴²

This population group tends to be frequent users of over the counter medicines such as cough sweets, laxatives, antacids and various tonics which are all generally high in sugar.⁵⁹ If these medicines are required, the use of sugar-free alternatives should therefore be recommended (see Appendix 8).

There are a number of risk factors that can result in the erosion of tooth enamel. These are usually related to gastric reflux associated with certain medical conditions (eg, hiatus hernia, obesity and bulimia), medicines (eg, aspirin) or dietary factors (eg, the consumption of acidic drinks or of citrus fruits (see sections on 'Fruit and vegetables' pages 24–26 and 'Dental erosion' pages 18–22).

While controversy exists in relation to nutritional status and denture wearing, social and economic factors, together with

a reduced appetite common in later life, are probably of greater nutritional significance.⁶⁸ Older people should be encouraged to eat a varied nutrient-dense diet, choose high fibre foods and ensure a good fluid intake. This should be combined with regular physical activity, suited to the individual's physical ability.

Recommendations

- The total consumption of free sugars should not exceed 10% of the total dietary energy intake per day nor 11% of total food energy for those not consuming alcohol (see Appendix 1).
- The frequency of free sugars should ideally not exceed four times daily, including meal times. Where individuals have a high frequency of sugar intake it may be appropriate to agree a more achievable short-term interim frequency (eg six times a day) as a means of facilitating a transition to the recommended four times a day. This is also applicable to those who are edentulous (without natural teeth).
- Older people should be encouraged to eat a variety of foods, choose high fibre foods, and consume 8–10 cups of fluid per day (ideally water, however tea or coffee without sugar are also acceptable).

- The consumption of sugary or acidic drinks such as squashes, fizzy drinks, fruit juices and fruit teas should be limited to meal times.
- The use of fluoride mouthwashes, fluoride toothpaste, or drinking fluoridated water reduces the prevalence of root caries and should be encouraged.
- Wherever possible sugar-free medicines should be used.
- Chewing sugar-free gum may help to stimulate salivary flow and improve the ability of salivary glands to respond to future stimuli.
- Regular physical activity (suited to the individual's physical ability) should be encouraged as a means of maintaining appetite and weight.

Appendix 1: Average energy requirement and sugar intake

The government report *Dietary reference values for food energy and nutrients in the United Kingdom* states that, on average, 'free' sugar intake should not exceed 11% of the total food energy (calorie) intake for adults (excludes alcohol).²¹ Based on average energy requirements, this is equivalent to the following sugar intakes.

	Age (years)	Estimated average daily energy requirements (kcal) ^a	Grammes of free sugars per day ^b (calculated as 11% of total food energy)	Number of teaspoons of free sugars per day
Children	1 to 3	1165–1230	32–34	6–7
Children	4 to 6	1545–1715	43–47	9
Children	7 to 10	1740–1970	48–54	10–11
Children	11 to 14	1845–2220	51–61	10–12
Children	15 to 18	2110–2775	58–76	12–15
Adults	19 to 59	1990–2550	55–70	11–14
Older people	60 to 74	1990–2380	55–65	11–13
Older people	75+	1810–2100	50–58	10–12

a) The lower end of this range applies to females and the upper end to males.²¹

b) The figures for free sugars include sugars that are not contained within the cell walls of food, ie mostly sucrose used as table sugars and used in baked foods and confectionery as well as honey. Some foods contain much more added sugars than others. It is the foods and/or drinks with a high sugar content (eg confectionery, cakes, biscuits, table sugars and soft drinks) that should be reduced as a priority rather than foods that contain small amounts of added sugar but are nutritious and form an important part of a healthy diet (eg non-sugar coated breakfast cereals, baked beans, bread).

Appendix 2: The sugar and fat content of common sweets, biscuits, drinks

Product description	Number of sugar cubes ^a	Number of teaspoons of sugar ^b	Number of fat pats ^c
Sweets			
1 tube fruit pastilles (52.5g)	11	6½	-
1 bar milk chocolate (60g)	11	7	2½
1 bag Jelly Babies (225g)	60	36	-
1 bag boiled sweets (100g)	29	17½	-
1 bag toffees (100g)	17	10	2⅔
1 Mars Bar (65g)	14	8½	1⅔
1 bag Dolly Mixtures (190g)	55	32½	1
1 tube Polo Mints original (30g)	10	6	-
Biscuits			
3 Chocolate Bourbons	3	2	1
3 Jaffa Cakes	6	4	½
3 Custard Creams	4	2½	1
1 milk chocolate digestive	2	1	½
1 chocolate biscuit, eg Penguin	3	2	1
Drinks			
1 can Coke (330mls)	12	7½	-
1 can Lucozade (330ml)	18	10½	-
1 carton diluted Ribena (288ml)	13	8	-
1 can Sprite (330ml)	11	6½	-
1 can Fanta (330ml)	10	6	-
Lucozade Sport (330ml)	7	4	-
Red Bull (250ml)	9	5½	-
Miscellaneous			
1 scoop plain ice cream	4	2½	⅔
1 tsp jam	1	½	-
1 packet Walkers crisps (34.5g)	-	-	1⅔
1 packet Walkers Lites low-fat crisps (24g)	-	-	⅔
1 packet of nuts, roasted and salted ^d (50g)	-	-	3½
Medium sausage roll	-	-	2½

- a) Each sugar cube weighs 3g and the total number is calculated to the nearest cube. Sugar cubes weighing 3g include Silver Spoon sugar cubes and McKinney's sugar cubes.
- b) The equivalent number of teaspoons of sugar is calculated to the nearest $\frac{1}{2}$ teaspoon. Each teaspoon of sugar weighs approximately 5g.
- c) Each fat pat, ie mini pack of butter or margarine, weighs 7g and the total number is calculated to the nearest $\frac{1}{2}$ or $\frac{2}{3}$ pat. Butter pats can be used to illustrate this, but they are not an exact representation. If used, place them upside on the table to represent fat, not butter.
- d) Whole nuts are not recommended for children under five years old because of the risk of choking.

Appendix 3: The sugar content of infant drinks and rusks

Drinks

Brand of infant drink	Unit	Approx. number of sugar cubes per unit (number of teaspoons in brackets) ^a	Approx. number of sugar cubes per 100mls (3fl oz) ready to drink (number of teaspoons in brackets) ^a
Boots			
Concentrated baby, orange and rosehip	330ml bottle	5 (3)	1½ (1)
Concentrated baby, blackcurrant and rosehip	330ml bottle	5 (3)	1½ (1)
Organic apple and blackcurrant juice	600ml pouch	15 (9)	2½ (1½)
Cow & Gate			
Pure baby juice (concentrated)	175ml glass bottle	4½ (2½)	2½ (1½)
Diluted pure baby juice drink	125ml glass bottle	3½ (2)	3 (1½)
Diluted fruit juice (from concentrate), ready to drink	500ml bottle	12½ (7½)	2½ (1½)
Heinz			
Pure juice concentrate	750ml bottle	25 (15)	3 (2)
Organic diluted pure fruit juice	750ml bottle	19 (11½)	2½ (1½)

Hipp			
Apple and grape fruit juice, ready to drink	500ml	19½ (12)	4 (2½)
Apple, pineapple and banana juice, ready to drink	200ml	4 (2½)	2 (1)
	500ml	10 (6)	
Mixed fruit juice, ready to drink	500ml	19 (11)	4 (2½)
Apple juice and mineral water, ready to drink	500ml	20 (12)	4 (2½)
Mixed fruit juice and mineral water, ready to drink	200ml	5 (3)	2½ (1½)
	500ml	12 (7)	

a) Each sugar cube weighs 3g and the total number is calculated to the nearest ½ cube. (Sugar cubes weighing 3g include Silver Spoon sugar cubes and McKinney's sugar cubes.) The equivalent number of teaspoons of sugar is calculated to the nearest ½ teaspoon. Each teaspoon of sugar weighs approximately 5g.

Rusks

Brand of infant rusk	Weight per rusk (g)	Quantity of sugars per rusk expressed in sugar cubes (number of teaspoons in brackets) ^b
Boots		
Organic rusks	10	½ (¼)
Plain/red fruit/apricot		
Farleys		
Original	17	1½ (1)
Reduced sugar original	17	1 (¾)
Gluten free, reduced sugar	24	1½ (1)
Banana, reduced sugar	17	1 (¾)
Mini rusks original	5	½ (¼)
Bickiepeggs		
Bickiepeggs teething biscuits (not intended to be eaten, rather to be used as a natural teething aid)	5	trace

b) The term 'sugars' refers to all monosaccharides (eg glucose) and disaccharides (eg sucrose, lactose and maltose) but excludes polyols (eg sorbitol). The amount of sugar is calculated to the nearest ½ sugar cube and ¼ teaspoon.

Appendix 4: Sugar intake targets

The overall aim should be to reduce both the total amount and the frequency of consumption of free sugars. This is best achieved by reducing the intake of confectionery, table sugar and ordinary soft drinks and squashes and having them less often.

The ideal target

The ideal target for the majority of people is a maximum of four sugar intakes per day:

- three of these should be taken at meal times plus one additional snack and/or sugar containing drink;
- all other snacks and drinks should be sugar-free.

An interim target

(Short-term target for individuals with a high sugar frequency)

Where individuals have a particularly high sugar frequency it may be appropriate to agree a short-term target as an interim measure. For example, it may be appropriate to agree an interim target of five or six sugar intakes for an individual who currently has eight to ten intakes per day.

Appendix 5: Suggestions for between-meals snacks and drinks

The following pages outline snack and drink choices that have been classified into three groups: **'Stop!'**, **'Think...'** and **'Go!'**, according to their contribution to dental and general health. The characteristics of each category are shown below.

Because of the varying nutritional requirements at different life stages it is difficult to develop a guide applicable to all age groups. When using this guide to provide nutrition and dental health advice to groups and individuals it is therefore essential to consider the nutritional needs of those for whom the advice is being provided.

For example, young children may require three nutritious snacks in addition to three meals each day because of their high energy needs and small appetites. Similarly, frail elderly people may require more nutritious between-meal snacks. For both of these groups, the bread-based snacks, cereals and yogurts outlined in the **'Go!'** section will be important in terms of their overall dietary intake. Adults who are trying to lose weight will also require three meals each day but with only drinks such as water, tea and coffee and lower calorie snacks such as fruit, between meals.

Stop!

A poor snack and drink choice.
May contain high levels of sugar, fat or salt.
Generally of limited nutritional value.
These should **not be taken between** meals.

Think...

A better snack and drink choice.
May contain some sugar, fat or salt.
May contribute to dental erosion owing to
level of acidity.
Most are of fairly good nutritional value.
These should **not be taken too frequently
between** meals.

Go!

The best snack and drink choice.
Most are sugar-free and are lower in fat and salt.
Most make a valuable contribution to a
healthy balanced diet.
These are the **best choices between** meals,
although some may not be suitable for adults
who are watching their weight.

In certain circumstances, eg where there is a medical condition or special nutritional needs, this guidance may not be appropriate. If in doubt seek advice from a registered dietitian.

Stop!

Not recommended between meals

- These foods and drinks are not recommended between meals as most have a high sugar content. Some may be dangerous for infants and young children, therefore are definitely not suitable, eg toffees, muesli bars, alcopops.
- They may also be high in fat or salt or both and are therefore not considered to be healthy choices.
- If taken, have them at the end of a meal (when they are less damaging to teeth) and not between meals.

Snacks

- Sweets and toffees
- Chocolate
- Ice cream
- Lollipops
- Chocolate, jam, wafer and cream biscuits
- Cakes and buns
- Cereal/muesli bars
- Jams, marmalade (including reduced sugar varieties), honey and chocolate spread
- Sweetened cereals, eg Frosties Cocoa Pops, Honey Nut Loops
- 'Luxury' yogurts including those with added chocolate, toffee, honey, crumbles, etc
- Dried fruit^a
- Crisps, corn snacks (including low-fat varieties)

Drinks

- Fizzy drinks or minerals containing sugar
- Sports drinks
- Alcopops
- Diluting cordials and drinks containing sugar
- Pure fruit juice^b

a) Dried fruit has a high concentration of sugars and is therefore not regarded as a suitable between-meals snack. However, if taken at mealtimes dried fruit can help to meet the five portions a day target. One portion of dried fruit counts, but other types of fruit and vegetables should be eaten to meet the rest of the five-a-day target.

b) Pure fruit juices are not recommended as between meal drinks and are best taken at mealtimes. They only count as one of the five portions of fruit or vegetables per day, even if more than one portion is consumed.

Think...

These snacks and drinks should not be taken too frequently between meals

- Most of these snacks and drinks are nutritious, but still contain some sugar, fat or salt.
- These are best taken with meals (when they are less damaging to teeth) and should not be taken too frequently between meals.
- Choose the low-fat, low-sugar, low-salt varieties where possible.
- Although some of these drinks do not contain sugar they may be acidic and can cause dental erosion and it is preferable to drink fluids listed in the 'Go!' section.

Snacks

- Breakfast cereals, eg Branflakes, Shreddies, Weetabix, cornflakes, unsweetened muesli^{a,e}, Rice Krispies (NB do not add sugar to cereal)
- Oatcakes^b
- Small portion of cheese (no more than 28g/1oz) preferably reduced fat, eg reduced fat cheddar, Edam, Gouda^c
- Scone, crumpet, pancake
- Sandwich, eg tuna, lean meat, egg, cheese
- Baked beans on toast
- Plain biscuits, eg Marie, Rich Tea, Digestive, or plain Hob Nobs^d
- Fruit yogurt (preferably low-fat)^c
- Nuts (preferably unsalted)^{a,e}

Drinks

- Plain sparkling water and unsweetened fruit flavoured water^e
- Fruit smoothies made with yogurt, milk, ice (not ice cream based)
- Well diluted pure fruit juice
- Well diluted sugar-free squash or cordials^e (NB one part squash to 10 parts water)
- Low calorie fizzy drinks^{d,e}

a) Whole nuts are not recommended for children under five because of the risk of choking.

b) Oatcakes have been classified under 'Think...' rather than 'Go' owing to their high salt content.

c) For children under five years old standard (full-fat) varieties of cheese and other dairy products are recommended.

d) Ideally these products should not be taken between meals. However, they have been included as an interim measure to facilitate change from the current position to the ideal.

e) Not suitable for infants and young children.

These are the most suitable snacks and drinks between meals

- These are the best snack and drink choices for both dental and general health.
- Most choices are sugar-free, low in fat and salt and provide valuable vitamins or minerals or both.
- Remember the importance of a good fluid intake.

Snacks

- Fruit, eg apples, pears, bananas, oranges (fresh, frozen or tinned in natural juice)
- Vegetables, eg pieces of carrot, celery, cauliflower, peppers
- Bread or toast (preferably wholemeal, wholegrain or wheaten^a)
- Plain rice cakes^a
- Plain breadsticks
- Unsalted plain or wholewheat crackers, crispbreads, water biscuits^a
- Sandwich with low-fat filling, eg cottage cheese, tomato, banana
- Homemade popcorn (without sugar, unsalted)
- Unsweetened cereals, eg Shredded Wheat, Weetabix, Ready Brek, porridge (NB do not add sugar to cereal)
- Homemade soup (not containing cream)
- Natural yogurt
- Natural yogurt with chopped fruit (fresh, frozen or tinned in natural juice)
- 'Diet/lite' yogurt^c, fromage frais^b
- Sugar-free chewing gum^c

Drinks

- Tap water, bottled still water (unflavoured)
- Milk – under one year of age breastmilk is the best choice; whole milk is recommended for children from one year onwards; semi-skimmed milk may be given to children from two years of age who eat a varied diet; skimmed milk should not be given to children under five years. For adults skimmed and semi-skimmed are preferable
- Tea/coffee (without sugar)^c

a) Plain or thinly spread with an unsaturated margarine, low-fat spread or butter.

b) For children under five, standard ('full-fat') dairy products are recommended rather than low-fat or 'diet/lite' varieties.

c) Not suitable for infants and young children.

Note

Healthy breaks schemes operate in many schools. While these snacks and drinks are generally considered to be 'healthy options', for different reasons some of them may not be included in the criteria for these schemes. Check with your local community dental service.

Appendix 6: A guide to what constitutes a portion of fruit and vegetables⁵⁷

As a guide, a portion is:

one piece of medium sized fruit, eg a pear or a banana;

or

two small pieces of fruit, eg kiwi fruit or plum;

or

one cup of very small fruit, eg grapes or strawberries;

or

one glass (150ml) of fruit juice^a (this can only be counted as one portion of the five-a-day target even if more than this amount is taken);

or

one tablespoon of dried fruit^b, eg raisins, currants, sultanas or three apricots or prunes;

or

three heaped tablespoons of vegetables;

or

one dessert bowl of salad.

Choose from fresh, frozen, tinned, dried or juiced. We usually think of potatoes as vegetables, but they are starchy foods like rice and bread. They are not counted in our five portions, but we should still eat them for the fibre they contain.

a) This is best taken at meal times because it is rich in naturally occurring sugars and is also erosive.

b) This is best taken at meal times and not as a between-meals snack because of the high concentration of sugars. The Department of Health recommends that other types of fruit and veg should be eaten to meet the five-a-day target.

Appendix 7: Making sense of food labels⁶⁹

Nutrient	High (these amounts or more)	Low (these amounts or less)
Sugars ^a	15g	5g
Fat	20g	3g
Saturates	5g	1.5g
Salt	1.5g	0.3g
Sodium	0.6g	0.1g

a) Although some products may appear high in sugars they can be healthier choices if they contain a lot of fruit or are milk based.

Appendix 8: Sugar-free medicines

Sugar-free medicines (ie those that do not contain fructose, glucose or sucrose) are available for the following therapeutic categories:

Analgesics and anti-inflammatories
Antacids
Anticonvulsants
Antidiarrhoeals
Antiemetics and antispasmodics
Antihistamines
Antiinfectives
Cardiovascular drugs
Central nervous system agents
Cough and cold remedies
Oral hygiene products (eg mouthwashes)
Laxatives
Respiratory products
Ulcer healing drugs
Vitamin and mineral supplements

The full list of medicines available in the above therapeutic categories can be found in an information leaflet entitled *Sugar content of medicines*, produced by the National Pharmacy Association: www.npa.co.uk

Further information can also be obtained from your local pharmacist, or by contacting:

Regional Medicines and Poisons Information Centre
Royal Group of Hospitals
Grosvenor Road
Belfast
BT12 6BA
Tel: 028 9024 0503 ext. 2032/3847

Appendix 9: Setting up a display to illustrate the 'hidden' sugar and fat in foods⁷⁰

- The basic requirements are a table, table-cover and selection of foods from the sugar and fat content list of common sweets, biscuits and drinks (see Appendix 2).
- Foods, sweets or drinks are placed on the table and their sugar and fat content are illustrated using sugar cubes and fat packs (eg mini-packs of butter). Display them beside the foods with the trademark face down, to avoid promoting specific brands.
- An alternative is to do a mini quiz. Ask clients or visitors at the stand to guess the number of sugar cubes or amount of fat in a variety of the foods listed on the sugar and fat content list (see Appendix 2). The answers could be written on a pre-prepared card placed beneath the foods, for the participants to uncover as they guess.

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