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Briefing Note

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SUGARS AND HEALTH

A Department of Health (DH) expert committee has recommended a reduction in overall levels of sugar consumption, mainly in view of the risk of dental decay. There is now debate over the implications and whether specific action to encourage people to reduce their sugar consumption is warranted.

This briefing reviews the effects of dietary sugar on health and related issues.

SUGARS, STARCHES AND ENERGY

The body derives its energy needs from many sources - primarily sugars, starches, fats, proteins and alcohol. Sugars[1] contribute between 10 and 20% of the energy in the typical UK diet. They are present naturally in many foods but are also added as sweeteners, texture improvers, bulking agents, stabilizers and preservatives. Some foods (e.g. meringues, boiled sweets) are essentially composed of sugars.

The DH's Committee on the Medical Aspects of Food Policy (COMA) 1989 report classified sugars into three categories (Figure 1) according to the availability of sugars to bacteria responsible for tooth decay (dental caries)[2]. **Intrinsic** sugars are contained in the natural structure of the food and were considered to be less available to mouth bacteria; **milk extrinsic** sugars are available to bacteria but do not cause caries because of protective components in milk. COMA considered that **non-milk extrinsic** (NME) sugars were the most available and the main dietary cause of caries. These include all sugars added to processed foods and those that occur in foods such as honey; Figure 2 shows the amounts of these sugars in some common foods.

The recent COMA (1991) report on Dietary Reference Values (DRVs)[3] recommends that average NME sugar intakes should not exceed 10% of total dietary energy; for the average person this represents about 60g (or 12 teaspoons) of sugar per day. This is consistent with a

Figure 1 COMA CLASSIFICATION OF SUGARS

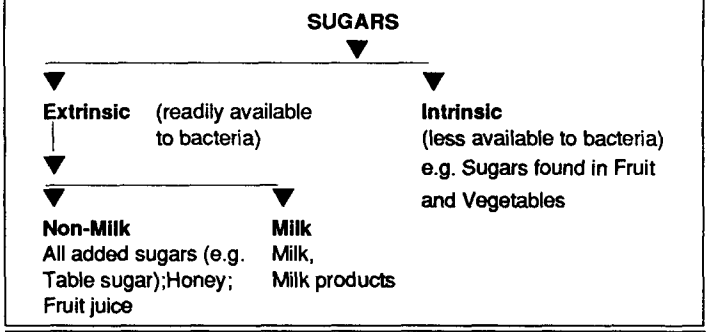
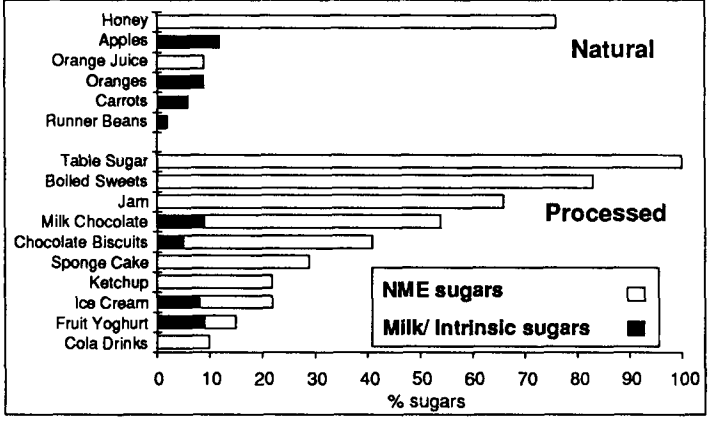


Figure 2 OCCURRENCE OF SUGARS IN SOME NATURAL AND PROCESSED FOODS



World Health Organisation (WHO) report of 1990 which recommended 'free' (effectively extrinsic) sugar should not account for more than 10% of average total energy intakes.

These recommendations were based on concerns over dental caries. Although COMA found no evidence to suggest that dietary sugars were the direct cause of other chronic diseases, they noted that extreme NME sugar intakes (greater than 30% of dietary energy) were undesirable (particularly in obese individuals), and may be linked with high blood cholesterol and insulin levels.

CURRENT CONSUMPTION AND TRENDS

There have been only a few studies which have measured the intake of NME sugars in various segments of the UK population. Studies of pre-school and school-children found that 7.8-18.9% of the energy intake was in the form of NME sugar, while with adults intakes were generally less. COMA concluded in 1989 that NME sugars constituted about 15-20% of the average daily food energy supply; thus the amount of NME

1. Technically, sugars are simple, soluble carbohydrates. They are usually composed of either one (e.g. glucose, fructose) or two (e.g. sucrose, lactose) basic units. When many of the basic sugar units link together to form chains, they result in more complex carbohydrates such as starch and cellulose.

2. Dental caries is caused by the action of bacteria (present in plaque on the surface of teeth); these feed on sugars and release acid which dissolves minerals (calcium and phosphate) from tooth enamel. Fluoride has a protective effect and also encourages remineralisation when the acid is removed.

3. Dietary Reference Values are guidelines on the average amounts of the most important dietary components needed by groups of healthy people. DRVs provide guidance to health professionals on the dietary requirements of population groups and do not necessarily relate to the specific needs of individuals.

sugars in the UK diet generally exceeds the levels recommended in COMA's 1991 report.

Figure 3 shows that, since 1981, sales of packet sugar have steadily fallen, but the total sugar supply has remained fairly constant, suggesting that consumers are buying more sugar in processed foods or in foods bought from catering establishments. Such sugar is often referred to as 'hidden' since the consumer may be unaware of its presence. Ministry of Agriculture Fisheries and Food (MAFF)'s dietary surveys suggest that sugars in processed foods now account for up to 70% of the total sugar consumed.

A major trend in the last decade has been the rise in the demand for 'low calorie' diet products. This has led to a massive increase in the use of artificial (intense) sweeteners - particularly aspartame - in products such as soft drinks and yoghurts. Aspartame cannot be used in cooked foods because it lacks heat stability. This and the fact that it cannot replace some of sugar's other uses has limited its impact on the overall demand for sugars.

POINTS OF SCIENTIFIC DISPUTE

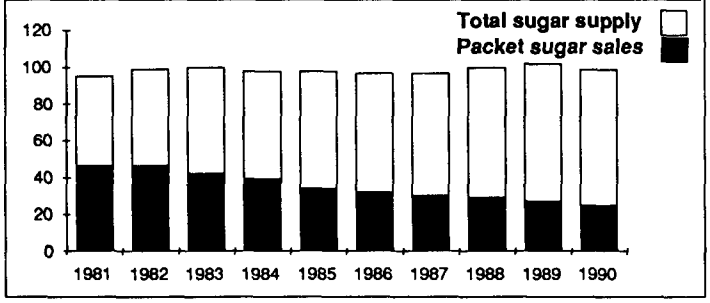
The COMA definition of NME sugar includes all refined sugars. The sugar, confectionery, food and soft drinks industries (e.g. Biscuit, Cake, Chocolate and Confectionery Alliance, the Sugar Bureau, the Food and Drink Federation and British Soft Drinks Association) take issue with COMA's recommendations on a number of grounds.

NME and other sugars. The COMA reports identified NME sugars as the most significant dietary cause of tooth decay. However, intrinsic sugars and starches have the **potential** to cause tooth decay, and the sugar and food industries have therefore questioned the validity of COMA's emphasis on NME sugars.

Laboratory studies can measure the extent of acid production and its effects on enamel from different types of carbohydrate. Such studies confirm that NME sugars are rapidly metabolised to acids which dissolve tooth enamel. However, studies also show that certain (highly heat-processed) starches may be broken down into their component sugars by saliva, and can then be metabolised to form acid. Additionally, acid formation from foods high in intrinsic sugars has been demonstrated under certain circumstances.

In view of the equivocal nature of the laboratory results, much attention has been focused on the results of epidemiological studies which relate different levels of sugar consumption to dental caries. Studies on populations with high and low sugar intakes in the UK and other countries show a consistent association between refined (i.e. NME) sugar consumption and dental caries rates. Other studies have shown that diets high in starch or fruit (i.e. intrinsic sugars) have only rarely been associated with elevated levels of caries.

Figure 3 TOTAL SUGAR SUPPLY AND PACKET SUGAR SALES (grammes/person/day)



While there are always inherent difficulties in trying to prove 'cause and effect' relationships between specific dietary factors and particular diseases, the scientific evidence was sufficient to persuade COMA that the most important sugars involved in dental caries were NME sugars.

Frequency and amounts of sugar. The relationship between the amount of NME sugar consumed in the diet and the incidence of caries is not straightforward. A Swedish study provided clear evidence that the **frequency** of exposure can be more important than the **amount** of NME sugar consumed. COMA recognised that the frequency of consumption was at least as important as the amount eaten, but considered that a recommendation to reduce total NME sugar intake would be more practical than one based on frequency of consumption. This has been disputed by the sugar and related industries who would prefer advice to focus on reducing the frequency of consumption (e.g. of sweet snacks).

Other factors. The Sugar Bureau and others have argued that dietary advice based solely on NME sugars is inappropriate since the effect of a food on dental health depends on a variety of other factors. These include substances that mitigate (e.g. calcium) or exacerbate (e.g. acid) tooth decay, the physical properties of a food that determine how long it stays in the mouth, the amount of saliva produced (saliva dilutes acid) and the extent of residues remaining on teeth. COMA, while recognising these factors, think that they do not detract from their conclusion that NME sugars have the greater effect on dental caries.

The Role of Fluoride. The widespread use of fluoride in toothpaste and in drinking water has reduced dental decay substantially (the Office of Population Censuses and Survey (OPCS) decennial survey shows that tooth decay in 12 year-olds fell by approximately 35% between 1973 and 1983; similar trends were observed in other age groups). Although the next OPCS survey is not due until 1993, the indications are that caries preva-

lence is still falling in most age groups but may be levelling off in pre-school children. Despite this improvement, many in the dental profession continue to see dental decay as a serious problem (e.g. the average number of decayed or filled teeth is 6.0 for age group 16-24 and 12.1 for age group 35-44). Moreover they see a limit to the extent of protection afforded by fluoride and suggest that further significant reductions in dental caries will require changes in diet. All the major UK professional dental bodies thus endorse the COMA recommendation to reduce consumption of NME sugar.

The Industry and others point out that fluoride use in the UK is largely through toothpastes and only about 10% of the (English) population receives fluoridated water. They thus see considerable scope for further reduction of caries through more widespread use of fluoride and point to the DH Chief Medical Officer's recent emphasis on the importance of facilitating new fluoride schemes. This and other non-dietary approaches (e.g. promoting oral hygiene) are seen by the Industry as more effective tools for reducing dental caries than dietary intervention of the type recommended by COMA. The evidence suggests that the protective effects of fluoride and reductions in dietary sugar are independent and thus both approaches can be justified as contributing to dental health.

SUGAR CONSUMPTION TARGETS

The recent 'Health of the Nation' Green Paper includes a target that, by the year 2003, the average 12 year old should have no more than 1.5 decayed, missing or filled teeth (DMFT). Some areas of the country already meet this target and thus many in the dental profession would like to see more stringent targets, perhaps set on a regional basis and including targets for pre-school children and adults. The DH has set up an Oral Health Strategy Group, chaired by the Chief Dental Officer, which is considering an oral health strategy for England which may include more detailed targets than those suggested in the Green Paper.

The 'Health of the Nation' Green Paper pre-dates COMA's 1991 report and does not specify targets for NME sugar consumption. Some believe that the COMA recommendation on NME sugars should be included in the forthcoming Health of the Nation White Paper, but it is not yet clear whether this matter will also have to be considered by the Oral Health Strategy Group. For the reasons previously discussed, any target for a reduction in NME sugar intakes would be opposed by the sugar and related industries.

Resolving these differences would be helped if it was clear how far current sugar consumption differed from the COMA recommendations, but information is limited. On dental caries, the OPCS survey provides tooth decay statistics for all age groups, but only every ten years; many health professionals see an urgent need for more frequent information. Another difficulty is that UK dietary surveys do not record NME sugars directly and often exclude those products (soft drinks, confectionery and food eaten outside the home) that are most likely to contain high levels of NME sugar. The estimates for current intakes are thus very approximate.

In this context, the group Action and Information on Sugars (AIS) point to circumstantial evidence that participants in dietary surveys under-report intakes of foods perceived as being unhealthy (e.g. those high in sugars or fats). AIS thus believe that the true level of NME sugar intake is close to 20% of total energy intake. COMA recommended in 1989 that the Government should monitor the average and extreme intakes of NME sugars. This is not currently under-way, but MAFF are presently considering ways of implementing this recommendation.

PUBLIC INFORMATION AND EDUCATION

Targets for reducing dental caries could be met in a number of ways. The public could be encouraged to brush their teeth more regularly, the use of fluoride could be extended, and people could be encouraged to change their eating habits to reduce dental decay. COMA and others argue that irrespective of improved dental hygiene or extended use of fluoride, a case for reducing NME sugar intake can be made; the Industry see this as a last resort after full application of preventative strategies and then to be focused only on those still at most risk of dental caries (e.g. social classes IV and V where caries rates are highest).

It is relevant to the debate over the role of dietary education that consumer surveys show that the public recognise sweet foods as contributing to dental decay, and many regard it as desirable that they consume less sugar. Moreover a major factor in reducing sugar intake is the trend to 'healthy' eating and weight-watching which encourage consumption of diet drinks etc. The fall in the sales of packet sugar (Figure 3) suggests that consumers are consciously attempting to reduce dietary sugar intakes. However, while a consumer can readily cut back on visible sugar, the majority is found in processed food and therefore hidden unless the sugar content is clearly stated on the label.

Food labelling is regulated under the Food Safety Act 1990 and the Trade Descriptions Act 1968. At present, most nutritional declarations are controlled only by the general requirement that they be true and not misleading, though the Government has been encouraging industry to follow voluntary guidelines issued in 1988. A recent EC directive on nutritional labelling will soon be incorporated into UK law. This will require that

claims such as 'low in sugar' be backed by a statement of the nutritional content[4], but there will still be no requirement to state the nutritional content of foods for which no claim is being made.

Food industry figures suggest that the majority (75%) of food labels already contain nutritional information supplied voluntarily by the manufacturers, although this is not always detailed enough to allow the consumer to assess a food's sugar content (sugars are often declared just as 'carbohydrates'). Groups such as AIS argue that MAFF should introduce compulsory nutritional labelling which would *inter alia* specify the sugar content. Some in the Industry are against the separate declaration of sugar content on food labels because they believe it implies that sugar is bad for health.

Many feel that steps should be taken to make nutritional labelling easier to understand. In this context, the big supermarkets have investigated the possibility of introducing coding systems to describe high, intermediate or low levels of specific nutrients. However, such systems would not be permitted under the new EC directive and progress in this area is dependent upon further consideration by the EC.

Consumers' information sources are dominated at present by dietary advice published by the major supermarkets, who have taken up advice published by the Government (mostly via the Health Education Authority). For instance, supermarkets such as Tesco and Sainsbury have published over 50 million nutritional leaflets since the mid 1980's. However, since many supermarkets use dietary leaflets as a way of promoting their own label (low sugar) products, there are concerns that dietary advice will be confined to those product areas where own-label brands are traditionally most competitive.

ARTIFICIAL SWEETENERS

Artificial sweeteners such as aspartame do not contribute to dental caries. Their use is however limited to 'low calorie' drinks, yoghurts and other cold products, partly because of a lack of heat stability, but also because they cannot replace the preserving, bulking and other uses of sugars. Extensive research programmes are underway to develop additional sugar substitutes (one such product, sucralose, was recently approved for use in Canada).

These technical trends, combined with the healthy eating promotional campaigns being instigated by the major supermarkets, could in themselves lead to a gradual reduction in NME sugar consumption. Nevertheless, there is support amongst health professionals for official targets to be set for reducing NME sugar intakes.

Table 1 CURRENT DIETARY GUIDANCE IN THE US AND UK

USA	UK
• Eat a variety of foods	• Enjoy your food
• Maintain healthy weight	• Eat a variety of different foods
• Choose a diet low in fat, saturated fat and cholesterol	• Eat the right amount to be a healthy weight
• Choose a diet with plenty of vegetables, fruits and grain products	• Eat plenty of foods rich in starch and fibre
• Use sugars only in moderation	• Don't eat too much fat
• Use salt and sodium only in moderation	• Don't eat sugary foods too often
• If you drink alcoholic beverages do so in moderation	• Look after the vitamins and minerals in your food
	• If you drink, keep within sensible limits.

OTHER IMPLICATIONS

A reduction in NME sugar intakes, although primarily aimed at reducing caries, may also have wider health implications. On the positive side, a recent WHO (1990) report and COMA point out that if sugar is replaced in the diet with alternative energy sources high in minerals, vitamins and fibre (such as vegetables, cereals and fruit), general health would be improved (this forms the basis for the Healthy Eating Campaign recently launched by the Consumer Association). However there is often an inverse relationship between the amounts of sugar and fat in the diet. Thus a reduction in sugar could lead to an increase in fat intakes which would not improve general health. This suggests that any educational message should make clear the strategy to be adopted to reduce sugar consumption. Thus, guidance in the US and UK combines a number of positive messages (see Table 1).

There are also financial and commercial implications. Dental diseases (primarily caries) cost the National Health Service around £1,000m each year. Reductions in sugar consumption would also effect the producing countries and the UK-based refining industry. Recent industry estimates are that compliance with the COMA recommendation could lead to a fall in sugar consumption of at least 300,000 tonnes. This would affect producers of sugar cane in Africa and the Caribbean and sugar beet growers in Europe, with implications for the EC Sugar Regime, Common Agricultural Policy and the Lomé Convention (under which certain developing countries have guaranteed access to the European market).

FURTHER READING

Additional details and background information are available from POST, 2 Little Smith St., London SW1P 3DL, tel: (071)-222-2688.

4. MAFF are currently drafting regulations to implement the Directive in two stages. From 1993 any nutritional claim (implied or explicit, relating to any nutrient) will trigger a declaration of the so called "big 4" nutrients (energy, fat, carbohydrate and protein). From 1995 the required declaration will include levels of sugars, saturated fat, sodium and fibre.

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