This first edition of 2007 provides us with the latest views on fructose; on the international situation in dental decay; and on the role of sugar in children’s diets.

Fructose, often still called “fruit sugar”, is highly symbolic. It was widely offered to diabetic patients in the 80s. What is the position today, in 2007? Can rising consumption be regarded as a factor contributing to the obesity epidemic and the metabolic diseases that accompany it? These questions and some others are addressed here.

What does the WHO have to say about the dental caries situation around the world? It tells us that only 20% of the world’s population have a sound knowledge of the role of fluoride in the prevention of caries. Never the less comparison of the results recorded between 2000 and 2004 indicates a decline in caries in the 188 countries studied.

Finally, the question of the place of sugar in children’s diets is tackled through the conclusions of the reports of major scientific committees. These are unanimous in concluding that sugar can form part of a healthy diet for children and adults alike.
**Fructose in the diet**

Fructose is found naturally in fruits but also, in smaller amounts, in vegetables. Honey also contains substantial amounts of fructose (about 40%). Other dietary sources include sucrose, in which fructose and glucose are combined in equal amounts. Similarly, fructose makes up approximately 50% of the sugars in “isoglucose” (termed “high fructose corn syrup” in most countries outside Europe).

**Applications**

Fructose is sweeter than sucrose but the difference between the two varies with the temperature of the food or drink at the time of consumption; with concentration; and with acidity. Maximum sweetness is perceived in a cold, low solids, acidic food system, e.g. soft drinks. Fructose also provides flavour enhancement, especially in fruit-flavoured foods. It improves browning in bakery products, and prolongs shelf-life. It is used in low-solids fruits preparations for dairy products, and in jams and jellies.

**Metabolism**

Fructose is either directly utilised to provide energy; or converted to glucose; stored as glycogen; or utilised to synthesise triglycerides. How fructose is used depends on an individual’s health and physical activity status; their intake levels and consumption patterns; and their intake of other macro-nutrients.

**Fructose and lipid metabolism**

Some human studies on the effect of fructose intake on blood fat levels have suggested an increase in triglycerides or cholesterol. However, the mean increase observed in each of these studies was minor; and the increased values usually remained within the normal range. Other studies have not reported comparable results.

**Fructose and diabetes**

Carbohydrate foods that need a lower secretion of insulin and do not stimulate a large rise in blood glucose may be helpful in the management of diabetes. Fructose does not require insulin for metabolism and also stimulates only a modest rise in blood glucose. Short-term studies have shown that replacement of some of the other dietary carbohydrate sources with fructose in the diabetic diet improves blood glucose control. Some longer-term studies have shown similarly encouraging results, and additionally have not shown adverse effects on blood lipid levels. However, more research is needed to reach more precise conclusions.

**Decline of the global caries burden**

The oral health database of the World Health Organisation, the so-called Country/Area profile programme (CAPP) provides the basis for the assessment of the dental caries situation worldwide. The number of decayed (D), missing (M) and filled (F) teeth (T) of the permanent dentition in twelve year old children serves as the indicator for the severity of the disease. Severity is classified according to the number of teeth affected. A very low caries prevalence means that on average less than 1.2 teeth are affected by tooth decay, whereas a level of 1.2 to 2.6 decayed teeth is low and the range of 2.7 to 4.4 teeth is classified as moderate and more than 4.4 teeth is classified as high.

In the year 2000 data on caries prevalence for 184 countries were available. Of these countries 68% had less than three teeth affected by tooth decay. These countries had thus achieved the Goal for Global Oral Health set by the World Health Organisation as target for the year 2000. By the year 2001, 70% of the countries reported a mean DMFT of less than 3 for their 12 year old children.

In the year 2004 caries prevalence data from 188 countries were available. Figure 1 shows the mean DMFT values of the 188 countries, sorted from zero to high DMFT values.

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**Figure 1** The DMFT values for the 188 countries database in Feb 2004, sorted according to DMFT for 12 year old children


of the 188 countries, representing 74% of the countries, had a DMFT of less than 3 and about 95 (that is about 50% of all the) countries had a DMFT of less than 2. A new Oral Health Goal set by the World Health Organisation for the year 2010 of max 1.0 DMFT (which means very low caries severity) had already been achieved in the year 2004 by about 30 countries.

For better comparability of caries trends globally over time, and among the six geographical regions of the World Health Organisation, the “weighted global DMFT” was introduced. The “weighted DMFT” differs from the mean DMFT value for countries, as the calculation considers also population sizes. The “global” caries burden in the year 2001 was thus calculated as 1.74 weighted mean DMFT for 12-year-old children. In the year 2004, this value had further declined to 1.61 DMFT (Figure 2). This is an indication of the continuing caries decline during recent years. Corresponding weighted DMFT values were calculated to assess the caries burden of each of the six geographical regions of the WHO. AMRO (the Americas) had the highest weighted DMFT (with 2.76), while South-East Asia (SEARO), with 1.12, and the African Region (AFRO), with 1.15 had the lowest regional caries burden.

This ongoing global decline in caries should not be allowed to obscure the fact that at present (2006) only about 20% of the world’s population benefit from a sound knowledge about the caries-preventive effect of fluoride. Further efforts to promote the availability and regular use of fluoride toothpaste for oral hygiene will improve the overall dental health situation.

As with so many aspects of sugar and health, there are a lot of misunderstandings about the role sugar should play in children’s diets. It is widely, if mistakenly, believed that sugar encourages over-eating and hyperactivity; that it displaces more valuable foods, thus reducing vitamin and mineral intakes; and that it is solely responsible for tooth decay.

Many expert scientific committees have reviewed the evidence on sugar and health and most have taken an extremely conservative, risk-averse approach, especially when giving advice on children’s diets. Despite this extreme caution, all have concluded that sugar can form part of a healthy diet for children, as well as adults. The evidence does not support the notion that sugar contributes to obesity any more than the other sources of food energy, in fact, less so than fat. Over-consumption of food energy, whatever the source, will lead to body fat deposits increasing, but people who eat more sugar are generally less likely to be over-weight than people who avoid it.

Among children, careful studies have shown that sugar does not cause hyperactivity, even among children whose parents are convinced that it does. Children who consume higher than average amounts of sugar are no more likely to have diets inadequate in vitamins and minerals than those with lower intakes. As for tooth decay, there is little consistent evidence that higher consumption of sugar is associated with worse decay experience, except among those children who do not use fluoride toothpaste regularly.

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Tooth decay is a good example of where the sense of proportion in the debate on sugar and health has been lost. There is good evidence that the frequency of sugar consumption is likely to influence the risk of decay but clear evidence that overall amount consumed has no effect. So trying to alter the amount that children eat and drink will not influence their dental health. Encouraging them to limit the number of times a day that they eat something with sugar in it might have an effect but there is no evidence that it is an effective approach to decay prevention. Since starches are also a cause of decay, and eaten in far larger quantities, and just as often, as sugar, it is hardly surprising that just changing sugar consumption has proved to be ineffective.

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The only proven method of preventing tooth decay is to use fluoride, most effectively in tooth paste. The introduction of fluoride tooth paste has been one of the most successful public health developments of the last 50 years. Interestingly, its success has been almost entirely dependent on the commercial activities of the manufacturers. This might explain the reluctance of some commentators to give due prominence to this extraordinarily effective approach to decay prevention.

The fact that children who use fluoride tooth paste have little or no tooth decay, seemingly irrespective of their dietary habits, is most helpful, in light of research that has shown that children need regular carbohydrate intake to support their high physical and mental energy demands. Since all the common food carbohydrates are capable of being involved in tooth decay, it is fortunate that such an effective protective agent as fluoride is available.

Carbohydrate in children’s diets is important to supply glucose to the blood stream, and thus to the whole of the body. Glucose is important for working muscles (which require glucose for vigorous activity), for the liver (where it is stored) and especially, for the brain. Children have a high demand for glucose in the body to fuel active muscles during sport and play, and to fuel the brain adequately during school work. Brain requirements are particularly high, and children who miss breakfast (and will thus have had no source of carbohydrate since the previous evening) tend to show poorer concentration and performance at mental tasks than those given a carbohydrate rich breakfast, such as a cereal. The brain has the largest demand for glucose of any organ in the body and can only work properly if this is supplied from carbohydrate.

Sugar is part of the dietary carbohydrate intake and has advantages over some of the others. It has a lower GI than potato, rice, bread or most breakfast cereals. It has a strong and distinctive taste, which discourages overconsumption. This may be demonstrated by a simple household experiment. Trying adding more sugar to tea or coffee, or to a bowl of fruit, than a child normally wants. Just wait for the reaction! They will find it less desirable than their usual choice of amount. Put in substantially more and they will find it most unpleasant.

Sugar has been the victim of a great deal of misinformation from a number of sources. Ill-informed journalists, who are casual in their research, combined with aggressive, and often misleading, commercial promotion of alternative sweeteners have left the consumer without a clear enough picture of the facts to make an informed decision. Too many are missing out on the pleasure and benefit of moderate and guilt-free enjoyment of nature’s sweetener. Worse, they are denying their children both pleasure and a balanced attitude to food.

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