2001

Sugar: is there a need for a dietary guideline?

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Publication Details

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Abstract
There have been dietary guidelines in Australia since 1979 and all editions have included recommendations about sugar. This paper reviews changing recommendations in Australia, current levels of consumption, recent studies on the potential effects of nutrient dilution and dental caries, and discusses potential risks associated with a dietary guideline.

Keywords
sugar, dietary guidelines

Disciplines
Arts and Humanities | Life Sciences | Medicine and Health Sciences | Social and Behavioral Sciences

Publication Details
Introduction

When the first official dietary guidelines were established in Australia, three reasons were cited for avoiding too much sugar (dental caries, reduced intake of essential nutrients and obesity) and this recommendation was placed fifth out of eight — ahead of recommendations about fibre, salt and alcohol. In the new 1999 dietary guidelines for older Australians, dental caries is the only health condition still associated with sugar consumption and the advice to use added sugars only in moderation is ranked as least important out of twelve guidelines. Table 1 sets out the evolution of this dietary guideline over the past twenty years.\(^{(1-5)}\)

Clearly there has been a change in thinking about dietary recommendations on sugar. Emphasis has shifted from advice about all sugars to added sugars, and the importance of this guideline (as reflected in its ranking) has progressively declined. Partly this has been due to better knowledge about the impact of sugar consumption on nutrient intakes and health and partly due to a change of focus, with growing interest in this country in the concept of the glycemic index of carbohydrate-rich-foods.

Many developed countries (including Canada and Japan) do not include sugar amongst their dietary guidelines\(^{(6)}\) and FAO is now promoting the development of food-based dietary guidelines that do not focus on individual nutrients.\(^{(7)}\) This paper reviews some of the new information about sugar that has been published since the establishment of the last set of dietary guidelines for the general Australian population nine years ago and suggest that it is time to reconsider whether a sugar guideline is still needed.
Australian Sugar Consumption

Australian apparent total sugar consumption has remained relatively static this century, declining slightly from 50.8 kg per head per year in 1938-39 to 48.4 kg in 1996-97.\(^{(8)}\) Over this same time, there was an apparent trend for more of this sugar to be consumed in manufactured foods rather than as added table sugar (from 32% to 65%). Surveys of actual total sugar intake confirm that added sugar and refined sugar products are now a relatively small component of the total Australian diet. The 1995 national nutrition survey found that total sugars contributed 19.4% of adult energy intake\(^{(9)}\), with the most highly refined sources (sugar, honey, syrups, jams and spreads, confectionery and soft drinks) contributing just under 8%.\(^{(10)}\) This is slightly less than the value of 9-10% reported by Baghurst et al\(^{(11)}\) when they summarised the data from three surveys conducted in the 1980s.

Table 2 indicates the major sources of sugars in the Australian adult diet. While this analysis does not distinguish intrinsic food sugars and that added during manufacture, clearly over half of the sugar being consumed today comes from food categories that are generally being promoted as nutrient-dense foods (milk, fruit, vegetables, and cereals).

Surveys by CSIRO in both Victoria and South Australia in the early 1990s found that the proportion of the population meeting the dietary target for sugar was greater than for other
targets such fat, fibre or sodium.\textsuperscript{(12,13)} Table 3 presents some of the 1993 South Australian results. They show that most Australians already consume only relatively modest amounts of sugar. If we were to prioritise public health messages and activities on the basis of the proportion of the population not meeting recommendations, advice about sugar would appear to be much less important than other components of the diet.

\textbf{Sugar and Health}

Despite some ill-informed popular views to the contrary\textsuperscript{(14)}, all recent authoritative reviews have concluded that sugar intake is not related to diabetes, hypoglycemia, cardiovascular disease, or hyperactivity.\textsuperscript{(15-19)} One case-control study suggested that diets high in sugar increased the risk of colon cancer\textsuperscript{(20)}, but even in that study the lowest odds ratio was not in the group with lowest sugar intake, and the conclusion has been disputed by other reviewers.\textsuperscript{(21,22)}

Only three health concerns have been cited as the reasons for earlier Australian dietary guidelines about sugar. In each case, more recent research has raised questions about the relevance of the current guideline.

\textbf{Obesity}

In the background papers to the 1992 guidelines, the increasing proportion of the population who were overweight or obese was noted. It was concluded that "for this group of people especially, sugar intake should be discouraged as it contributes to the
excess in energy intake that is mainly responsible for obesity.\(^{(3)}\) In contrast, findings from a number of population studies over the past decade show an inverse association between the proportion of energy from total sugars and obesity.\(^{(23-27)}\) Indeed, since dietary fat and sugar appear to be inversely related \(^{(26,28-30)}\) some authors have suggested that advice to reduce fat and sugar simultaneously may be unattainable.\(^{(31)}\)

One Australian study, following dietary changes in adults over a four year period, found that changes in the percentage of energy from sugar were strongly negatively correlated with changes in percentage of energy from fat in both men and women.\(^{(32)}\) Some authors do still argue that extrinsic sugar can be a vehicle for dietary fat.\(^{(33)}\) However, while it is possible to identify some foods rich in both fat and sugars, in the context of the whole diet foods that are the primary sources of sugars are only minor sources of fat and vice versa.\(^{(28)}\)

There is also no conclusive evidence that the sweetness of sugar contributes to increased appetite. In fact the opposite may be true; the body tends to have a much better appetite-reduction response to carbohydrates and sugar than it does to dietary fat and reducing sugar could actually undermine appetite regulation.\(^{(34,35)}\) Certainly weight reduction can occur as well on high sugar diet (with 43% of energy from sucrose) as on a low sugar diet (with only 4%)\(^{(36)}\), and a recent British dieting book written by a Professor of Dietetics promotes increased sugar intake to assist in weight management.\(^{(37)}\) The FAO/WHO report\(^{(18)}\) concluded that “there is no indication that sugar is associated with excessive food intake” and energy control with the primary emphasis on restriction of fat, rather
than sugar, remains the cornerstone of recommended dietary treatment of obesity.\(^{(38,39)}\) Thus the best available evidence does not support any population dietary guideline for sugar intake on the grounds of obesity.\(^{(40)}\)

**Nutrient Dilution**

Table sugar has been labelled a food consisting only of "empty calories" and it had been argued that a high consumption of sugar might displace micronutrient-rich foods from the diet and increase the risk of deficiency. In the US there has been particular concern expressed about the quality of diets of people consuming large quantities of soft drinks.\(^{(41,42)}\) The new wording of the American dietary guideline ("Choose beverages and foods to moderate your intake of sugars") cautions consumers not to let soft drinks crowd out other foods needed to maintain health, such as low-fat milk.\(^{(43)}\) However, national dietary guidelines need to reflect each country’s own nutritional priorities and there are significant differences between the US and Australia, with a lower level of soft drink consumption in this country - contributing only 2-3% of the energy intake of adults\(^{(10)}\) - and higher milk intakes.

Moreover, many studies in the US and the UK have shown that in most cases energy and nutrient intakes are positively related to total sugar intake\(^{(24,29,30,44)}\). The COMA Report\(^{(45)}\) concluded "on average people with high total energy intakes eat more of all nutrients including sugar" and "sugar intake is a weaker predictor of absolute micronutrient intake than total energy consumption".
A number of authors have examined the relationship between the proportion of energy from sugar and micronutrient intakes. Baghurst et al (46) divided the intakes of 2800 Australian adults into tenths according to the percentage of dietary energy from added sugars, ranging from <4.7% to >19.3%. Intakes of vitamin B6, B12, carotene, folate, magnesium and zinc demonstrated an inverse trend with added sugar, but the decline was only significantly different from the median in the highest and lowest deciles. Across the broad range of 4-16% energy from added sugars there was no significant variation in micronutrient intakes. Results from several other studies vary depending on the classification of different sugars used (29,47,48) but in general moderate sugar consumers appear to have the most adequate diets. Reviewers have concluded that added sugar intakes between 5% and 16% of energy do not appear to have any detrimental effect on micronutrient intakes (27), a range that spans the 20th to the 90th percentiles of the contribution of refined sugar to total energy intake in Australia. (11)

In conclusion, there does not seem to be any compelling evidence that the current level of sugar consumption in Australia has any detrimental effect on diet quality. The mean intakes of most vitamins and minerals exceed the RDIs, with the notable exception of calcium (9), and the percentage of Australian adults with calcium intakes below 70%RDI is lowest in those in the highest decile of percentage of energy from added sugars (46).

**Dental caries**

While there is no doubt that dental caries continues to be a significant public health problem in Australia, there have been dramatic declines in average levels of dental decay,
as defined by the number of decayed missing and filled teeth (DMFT) over the past three decades. In 12 year old children DMFT scores fell from approximately 8 in 1965 to 1.01 in 1995. These improvements are obviously the starting point for future improvements in oral health in later life, but even in adults the average number of missing teeth has fallen from 8.3 in 1973 to only 3.6 in 1995.\(^{(49)}\)

Until recently, it has been usual to blame sugar as the chief factor in the cause of dental caries. In 1991 Sheiham\(^{(50)}\) stated that "dental caries is a sugar induced disease" and recommended a maximum intake of 15kg/person per year (about one third of the current Australian intake). On the other hand, caries prevalence has decreased markedly during the past 30 years in most developed countries although the consumption of sugars has remained relatively unchanged.\(^{(51,52)}\) The main reason for this improvement has been the introduction of fluoridated toothpastes and water supplies\(^{(53)}\), rendering high-sugar diets less of a caries risk than they used to be 20 years ago.\(^{(51)}\)

In Australia too Sivaneswaran and Barnard\(^{(54)}\) concluded "the dramatic decline in dental caries bears no relationship to the apparent consumption of sugar, which has remained relatively high". A study of annual sugar consumption and dental records in 29 industrialised countries found sugar explained less than 1% of the variation in scores of decayed, missing or filled teeth (DMFT), despite a broad range of sugar consumption (from 80-195g/d).\(^{(55)}\)
The recent WHO/FAO expert consultation on carbohydrates confirmed that the incidence of dental caries is influenced by a number of factors. Foods containing sugars and starches that can be easily broken down by alpha-amylase and bacteria in the mouth can produce acid, which increases the risk of caries. Many starchy foods are as cariogenic as sugary foods, judged by the pH fall in dental plaque after consumption, and starchy foods with a high glycemic index can be worse than sucrose solutions.\(^{(56-58)}\) Thus the impact of carbohydrates on caries is dependent on the type of food, frequency of consumption, degree of oral hygiene, availability of fluoride, salivary function and genetic factors.\(^{(18)}\) In UK children, for example, the levels of consumption of the main sugar-containing food groups do not vary significantly across social classes, but the percentage of children with decayed teeth varies enormously, being more than six time higher in the class V versus class I.\(^{(59)}\) It is thought that oral hygiene practices are the most significant factor in this variation. Analysis of the UK National Diet and Nutrition Survey of children found no relationship between caries and consumption of extrinsic sugars, chocolate, or soft drink, and an association between caries and sugar confectionery was only present among children whose teeth were brushed less than twice a day.\(^{(60)}\)

Nonetheless, in public health we often make policies in relation to risk factors that may not be the most significant variables. The important questions to ask are: would lowering the mean intake of sugar further reduce the caries incidence in Australia, and would this be a cost-effective method of caries prevention? There are few intervention studies to help answer this question. The best evidence comes from examinations of the impact of sugar reductions at a population level. A review of data from 67 countries in the period
1982 to 1994 found no reliable relationship: of 43 countries where there had been a reduction in the per capita sugar supply, 18 had a decrease in DMFT and 25 had increases.\(^{(27)}\)

Even total removal of sugar from the diet would not necessarily eliminate caries in a population.\(^{(61)}\) Many other foods have cariogenic potential and some snacks like plain crackers and potato crisps result in slower and more prolonged release of acid than some sugar-containing snacks.\(^{(62)}\) The WHO/FAO report finally rejected the terms "extrinsic" and "intrinsic" sugars in favour of a "more rational approach to the role of fermentable carbohydrates in dental caries" and concluded that prevention programs to control and eliminate caries should focus on fluoridation and adequate oral hygiene rather than sucrose intake alone.\(^{(18)}\) This conclusion is supported by economic analyses that have found that advice about toothbrushing is likely to be a more cost-effective means of caries prevention than attempts at sustained dietary change.\(^{(63)}\)

**Are there any risks from a dietary guideline on sugar?**

It may be argued that the current recommendations to consume only “moderate” amounts of sugar are conservative and unlikely to cause any harm. But many consumers will interpret such a message as a general warning against all sugar consumption. If there are serious questions about the evidence available to support a general population guideline that aims to limit sugar consumption, the question then arises: can a dietary guideline on
sugar send any confusing or misleading messages to consumers or have any potential negative impacts on health? I believe that it can.

Confusion between sugar as a nutrient and a food

In all the research on the relationship between sugar and health, there is a constant difficulty in distinguishing between sucrose used as table sugar or as "added sugar" in manufactured foods from other naturally occurring sugars. The Australian food tables do not identify the source of sugars in foods and neither do the nutrition information panels on food labels. This dietary guideline helps to perpetuate the myth that sucrose and "added sugars" are in some way special; that added sucrose has different properties to the other sugars naturally present in many foods.

Consumers often rely on the nutrition information panel (NIP) on manufactured foods to make judgements about their nutritional value. How is the average shopper to evaluate the NIP on a food like dried fruit or low fat flavoured milk, when they are being advised to eat only a moderate amount of sugars? Focus groups in the US found consumers were confused by this apparent contradiction and recent ANZFA consultations with Australian health professionals about a new format for a NIP on all packaged food supported the removal of sugar from the mandatory list of nutrients to be declared. Diabetes educators in particular felt that many consumers were overly focussed on the sugar figure to evaluate whether a food was suitable for inclusion in a diabetic diet.
Sugar-Fat seesaw

The consistent inverse relationship between sugar and fat suggests that advice to moderate sugar intakes may lead to higher fat intakes, or at least make it much harder to keep them low. Even recommendations to eat more fruit and vegetables are probably going to increase the consumption of sugars if they are replacing fatty and salty snacks. We should recognise that the evidence for fat as a dietary risk factor is much stronger than that for sugar and focus our communication efforts there.

Glycemic Index (GI)

The new Dietary Guidelines for Older Australians are perhaps the first in the world to include advice about eating more low glycemic index foods, noting the FAO/WHO recommendations that the GI be used in conjunction with information on food composition to guide food choices. Increasingly it is being recognised that lower GI diets may be protective against diabetes and heart disease. There is little distinction between the glycemic index of foods containing naturally occurring sugars and those with added refined sugars. Foods containing sugar generally have low to intermediate GI values; by contrast, a low sugar intake has been associated with a higher dietary GI overall. Thus the old guideline helps to perpetuate outdated views about sugar and ignores the recent scientific developments in our understanding of carbohydrate digestion and metabolism.
Food restriction vs enjoyment and variety

The current sugar guideline promotes moderation in consumption, not unnecessary restriction of sugar-containing foods, except for those who are overweight. But we know that restrictive attitudes to food can begin at early ages and may have influence on the long-term development of disordered attitudes to eating.(67,68) A negative focus on problem-based messages implying that sugar is bad may contribute to underlying fears about food and weight gain, which can precipitate eating problems. Child-feeding practices that restrict children's intakes of foods at the top of the dietary pyramid may actually promote their liking for and intake of those foods.(69)

Humans are born with an genetic preference for sweet tastes (70) and have incorporated highly sweet foods such as honey in the diet for thousands of years.(71) The Dietary Guidelines for Older Australians acknowledge that “inclusion of a moderate amount of added sugar … can increase variety and palatability without compromising nutrient intake”.(5) As we come to recognise the importance of food variety for good health, we should also acknowledge that addition of sugars to products such as milk, yoghurts, fruit and cereals can significantly increase their appeal and therefore promote greater variety in the diet overall.
Conclusion

While the science on sugar has been changing, it also appears that consumers are now ready to accept a change in dietary advice on the role of sugar in the diet. A recent article in the Australian Consumers’ Association magazine Choice concluded: "if eating more sugar makes a healthy low-fat diet more palatable and easier to stick to, and you take good care of your teeth, there may be a case for relaxing your attitude to sugar". (72)

Perhaps in the next revision of the dietary guidelines, Australians would be better served by focusing attention on positive messages to increase intakes of desirable foods and communicating more about the concept of the glycemic index, rather than maintaining a restrictive message about a single ingredient for which there is little evidence of need to change current consumption levels.
References


<table>
<thead>
<tr>
<th>Date</th>
<th>Document</th>
<th>Wording of guideline</th>
<th>Ranking</th>
<th>Reasons cited</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>AAD dietary guidelines for Australians</td>
<td>Decrease consumption of sugars</td>
<td>3rd of 9</td>
<td>• Dental caries</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• Obesity</td>
</tr>
<tr>
<td>1981</td>
<td>Dietary guidelines for Australians</td>
<td>Decrease refined sugar consumption</td>
<td>5th of 8</td>
<td>• Dental caries</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Displacing nutritious foods and reducing intake of essential vitamin and minerals</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Obesity</td>
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<tr>
<td>1992</td>
<td>Dietary guidelines for Australians</td>
<td>Eat only a moderate amount of sugars and foods containing added sugars</td>
<td>6th of 10</td>
<td>• Dental caries</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• Obesity</td>
</tr>
<tr>
<td>1995</td>
<td>Dietary guidelines for children and adolescents</td>
<td>Eat only a moderate amount of sugars and foods containing added sugars</td>
<td>7th of 10</td>
<td>• Dental caries</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• May displace more nutrient dense foods</td>
</tr>
<tr>
<td>1999</td>
<td>Dietary Guidelines for Older Australians</td>
<td>Use added sugars in moderation</td>
<td>12th of 12</td>
<td>• Dental caries</td>
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</table>
Table 2. Main source of sugars in the Australian diet in the 1995 National Nutrition Survey (percent)

<table>
<thead>
<tr>
<th>Food Sources</th>
<th>Males 19+</th>
<th>Females 19+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk products</td>
<td>16.2</td>
<td>17.4</td>
</tr>
<tr>
<td>Soft drinks</td>
<td>15.5</td>
<td>9.3</td>
</tr>
<tr>
<td>Sugar products</td>
<td>13.7</td>
<td>10.8</td>
</tr>
<tr>
<td>Fruit</td>
<td>12.5</td>
<td>17.1</td>
</tr>
<tr>
<td>Fruit and vegetable juices</td>
<td>10.1</td>
<td>11.2</td>
</tr>
<tr>
<td>Cereal based products</td>
<td>10.1</td>
<td>11.2</td>
</tr>
<tr>
<td>Cereals</td>
<td>6.3</td>
<td>6.1</td>
</tr>
<tr>
<td>Vegetables</td>
<td>4.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Confectionery</td>
<td>3.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Sauces</td>
<td>2.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Meat</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Alcoholic beverages</td>
<td>1.5</td>
<td>1.6</td>
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</table>
Table 3. Percentage of the South Australian population conforming to dietary targets in 1993\(^{(a)}\)

<table>
<thead>
<tr>
<th>Target</th>
<th>Men</th>
<th>Women</th>
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<tbody>
<tr>
<td>Sugar</td>
<td>68</td>
<td>77</td>
</tr>
<tr>
<td>Fibre</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>Sodium</td>
<td>23</td>
<td>52</td>
</tr>
<tr>
<td>Fat</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>Sat fat</td>
<td>12</td>
<td>18</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Baghurst et al (reference 12)