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Australian Research Centre for Population Oral Health

Sugars-rich Diets and Oral Health: Information for Dental Practitioners

High consumption of sugars is the primary cause of dental caries and other health problems, such as overweight or obesity; type-2 diabetes; heart diseases and even some cancers, in the world

What are Sugars? – definition and classification

Total sugars are defined as all monosaccharides (e.g. glucose, fructose) & disaccharides (e.g. sucrose, lactose), but not polyols (e.g. sugar-free sweeteners).[1]

According to the Committee on Medical Aspects of Food and Nutrition Policy[1], sugars can be classified into:

1. **INTRINSIC Sugars** ***(or natural Sugars)*** i.e. where the sugar molecules are held within the cell structure of the food like fresh fruits.

2. **EXTRINSIC Sugars** i.e. where the sugar molecules are present outside the cell structure of the food or that are added to the food.

   Extrinsic sugars are further subdivided into

   2a. Milk Sugars ***(or natural Sugars)*** i.e. lactose present in milk and milk products (e.g. cheese, plain yogurt), which are less cariogenic and are accompanied by significant amounts of essential nutrients.

   2b. Non milk extrinsic Sugars, also called ***added sugars and free Sugars*** (or hidden sugars). These free sugars are of greater concern. These have no nutritional value and add to unnecessary calories. The term "free sugars" is defined as "all monosaccharides (such as glucose, fructose) and disaccharides (such as sucrose or table sugars) added to foods by the manufacturer, cook or consumer, or sugars that are naturally present in honey, syrups and fruit juices".

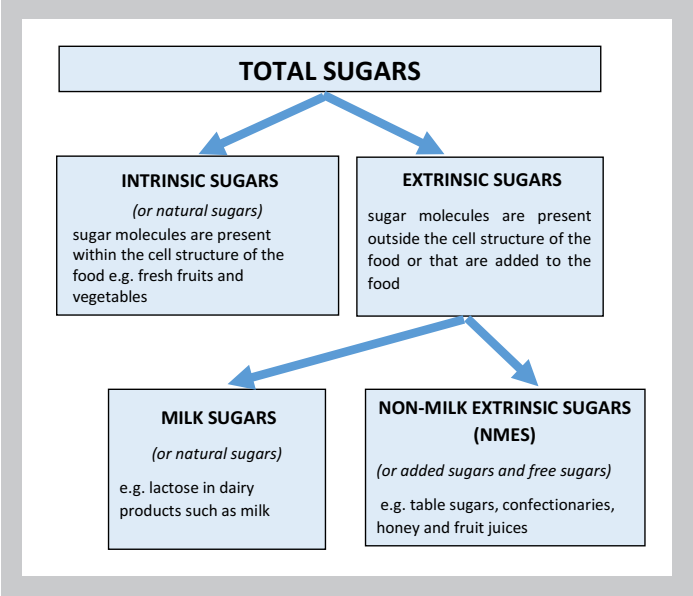

Figure 1. COMA report1

Effect of Sugars on both general and oral health

Excess consumption of sugars is harmful for both general and oral health. There is large quantity of good quality and strong evidence to suggest an association between high intake of sugars and both general and oral health related diseases. For example,

- A recent meta-analysis of randomised controlled trials and cohort studies reported that among the groups with the highest intake of sugar-sweetened beverages (SSBs) there was a 55% greater chance of being overweight or obese than compared with lowest intake.[2] Apart from SSBs, higher intake of sugars was also reported to be positively associated with weight-gain.
- Similarly, according to the findings from a recently conducted meta-analysis of 17 cohort studies, one serving of SSB per day was found to increase the risk of developing type-2 diabetes by approximately 18%.[3]
- Another recently conducted longitudinal study reported a linear dose-response relationship between intake of sugars and caries development.[4]

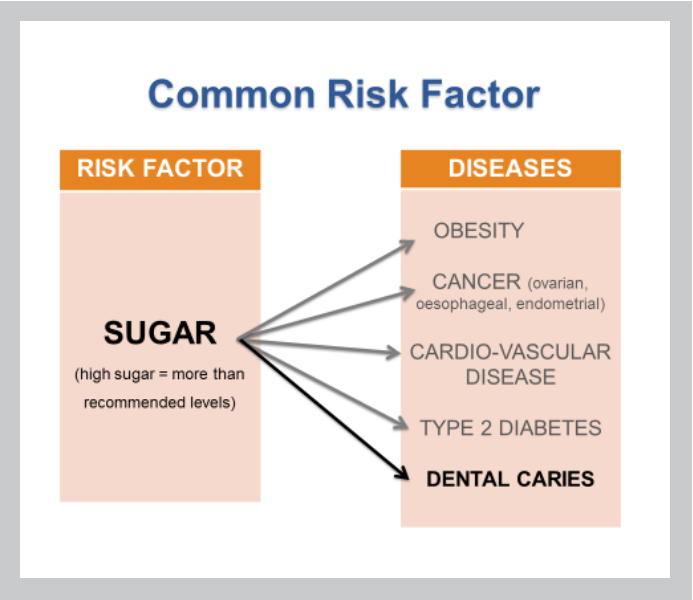

Figure 2: Adapted from Common Risk Factor Approach[5]

Potentially cariogenic and high free Sugars-containing foods

- Lollies and chocolate confectionery
- Cakes and biscuits
- Buns, pastries, fruit pies
- Sponge puddings and other puddings
- Table sugars
- Sugared breakfast cereals
- Jams, preserves, honey
- Ice cream
- Fruit in syrup
- Fresh fruit juices
- Sugared soft drinks
- Sugared, milk-based beverages
- Sugars-containing alcoholic beverages

Evidence	Decreased Risk	No Relationship	Increased Risk
Convincing	Fluoride exposure (local and systematic)	Starch intake (cooked and raw starch foods, such as rice, potatoes and bread; excludes cakes, biscuits and snacks with added sugars)	Amount of free sugars Frequency of free sugars
Probable	Hard cheese Sugars-free chewing gum	Whole fresh fruit	
Possible	Xylitol Milk Dietary fibre		Undernutrition
Insufficient	Whole fresh fruit		Dried fruits

Figure 3: Summary of strength of evidence linking diet to dental caries[6,7]

Roles of Sugars in dental caries

Many factors can contribute to the development of dental caries (both dietary and non-dietary factors). These include the presence of plaque-producing bacteria, susceptibility of tooth surfaces, frequency of eating, oral hygiene practices, fluoride availability, and salivary flow. Of all these factors, diet plays an important role and within diet, **sugars** are the major cause of dental caries[8].

Mechanism of dental caries

Sugars that we consume can be readily metabolized by many bacteria involved in dental biofilm formation, generating acid by-products that lead to demineralization of the tooth structure and ultimately, dental caries. Also, low levels of saliva (causing dry mouth) may worsen the process of demineralisation leading to dental caries. This may occur especially during night time or may also occur due to taking some medications (e.g. anti-depressants) or even extreme stress.

World Health Organisation's recommendations for intake of Sugars for children and adults

For the first time in 2003, the World Health Organisation (WHO) recommended the consumption of free sugars to be less than 10% of our dietary intake. Due to limited evidence at that time and growing doubts about the strength of the recommendation, the WHO decided to update the recommendations by forming an expert advisory group responsible for advising WHO on nutrition guidelines. Systematic reviews of randomised controlled trials and cohort studies were conducted separately for adults and children to identify evidence on effects of free sugars on dental caries and other health outcomes (overweight, obesity and type 2 diabetes). The results obtained in 2015 reaffirmed the 2003 recommendations of consuming <10% energy from free sugars. Based on further evidence, an additional recommendation of limiting free sugars to less than 5% of total energy was advised for additional health benefits. This recommendation was consistent for both children and adults. WHO also strongly recommends a reduced intake of free sugars throughout the life course[9].

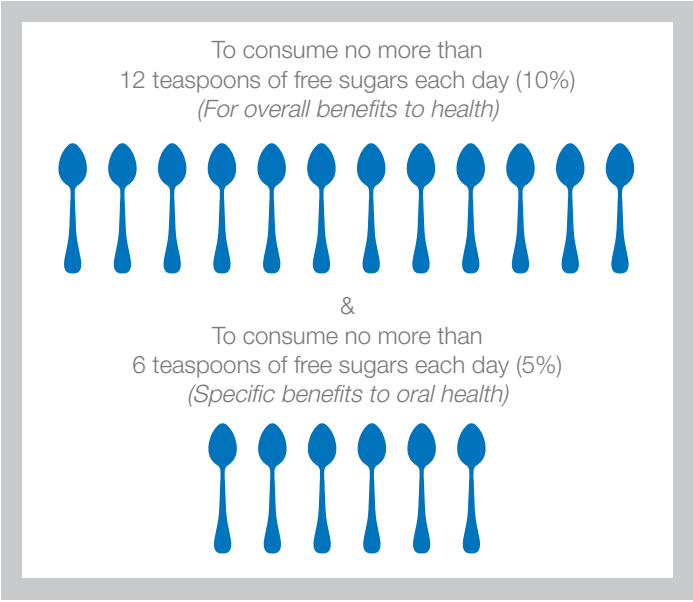

Figure 4: World Health Organisation free sugar intake recommendations[9]

Australian and New Zealand guidelines for the intake of Sugars

For Australia[10]

According to the latest Australian Dietary Guidelines, it is advised to "Limit intake of foods and drinks containing added sugars such as confectionery, sugar-sweetened soft drinks and cordials, fruit drinks, vitamin waters and sports drinks".

For New Zealand[11]

The New Zealand Food and Nutrition Guidelines states to "Prepare foods or choose pre-prepared foods, drinks and snacks, with little added sugars; limit your intake of high sugars-containing foods".

Figure 5: Australian Dietary Guidelines[10]

Current amount of Sugars consumed by Australians and New Zealanders

One in two (52 %) exceed the WHO recommendation of 10%.
Nine out of ten (90%) exceed the World WHO recommendation of 5%.

On average, the amount of sugars consumed by Australians and New Zealanders is **14 teaspoons** of sugars per day (60 grams)[12] .

Effect of patterns of Sugars intake

Sugars may be consumed in various patterns such as in a certain form (sticky or non-sticky), number of times a day (frequency) and in varied amounts (small or large amounts). Several studies conducted on both animals[13,14] and human beings[15-17] have found the impact of different patterns of consuming sugars on the development of dental caries.

Form of Sugars consumed

'Form' refers to the physical consistency of the sugars-containing food consumed which can be either in a liquid form or in an adhesive (sticky) form. The longer the sticky form of sugars-containing food remains in the mouth, the longer the drop in pH (low oral clearance due to low salivary flow) will remain[18]. This may enhance the cariogenic activity, thus increasing the risk of dental caries.

Frequency of Sugars consumed

How often we eat sugars can also influence our dental health. A high frequency of intake of sugars increases the overall length of time that the teeth are exposed to sugars. The cariogenic process is dependent upon the retention time of both the sugars-containing food and drinks. Sugars-containing food especially sticky food like chocolates, sweet biscuits and other sweet confectionaries have a high retention leading to greater exposure on tooth surfaces[18].

Amount of Sugars consumed

A recent systematic review of 55 studies (42 in children and 5 in adults) reported a positive association between amount of sugars consumed and caries development[7].
Other recent longitudinal studies have also reported that the amount of sugars consumption is positively related to dental caries[4,19], suggesting that the higher the sugars intake, the higher is the probability of developing dental caries. This evidence remains consistent for both children and adults.
This positive relationship between amounts of sugars consumed and dental caries experience among individuals also indicates that whatever the level of high sugar intake be, the actual accumulation of caries progresses throughout life[19]. Therefore WHO's recommendation of a reduced intake of free sugars throughout the life course remains strong and acceptable[9]. It must also be noted that as dental caries is a cumulative disease, high sugars consumption among childhood leads to a high prevalence of dental caries both among children and adults.

Summary of the key points on Sugars and dental caries

- Dental caries is a diet-mediated disease.
- Sugars are a common risk factor for general and oral health.
- Both amount and frequency of intake of sugars are important factors for dental caries to occur.
- Fluoride is effective for caries prevention but its impact is limited in the presence of sugars.
- The most dangerous types of sugars to watch for in the diet are ***added and free Sugars***.
- It is important to limit sugars intake to WHO recommendations for an overall healthy life.

As a dental practitioner, what can you do to help?

Advise your patient to

- Develop healthy dietary habits in children by introducing healthy options early in life.
- Not to add any sugars to baby's food and drink.
- Limit the amount and frequency of sugars-containing food and drinks consumed to the minimum possible.
- Eat more fruits, vegetables, unsweetened breakfast cereals and grains.
- Choose healthy alternatives such as drinking milk and water instead of sugars-containing drinks.
- Avoid the consumption of long-lasting sources of sugars (dried fruits, fruit leathers and hard or chewy sweets) close to bedtime. These stick to teeth and cause tooth decay.

- Read nutrition labels for amount of sugars (especially high fructose corn syrup or added/free sugars).
- Adhere to basic oral hygiene practices like brushing teeth twice a day, using fluoride toothpaste and tap water.
- Follow the Australian Dietary Guidelines[10] for more information on healthy eating.

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