

NUTRITION AND ORAL HEALTH

What does “nutrition” involve?

Nutrition encompasses the intake of food, digestion, absorption of nutrients, nutrient transport to target sites, storage of nutrients, metabolic use of nutrients and the elimination of the metabolic waste products from the body.

Nutrients, including macro-nutrients and micro-nutrients are necessary for the efficient function of all cell types throughout the body. Hence the important of a balanced diet avoiding poor dietary habits or nutrient deficiencies.

Nutritional health depends on a balanced diet, providing the body with fuel, **macro-nutrients** including protein, fats and carbohydrates and **micro-nutrients** including minerals, vitamins and trace elements.

A poor diet with **nutritional deficiencies** has been shown to be associated with a number of **systemic disease states** including diabetes, cardio-vascular disease, cancer, osteoporosis, gastro-intestinal disorders, obesity, hypertension and abnormal fat metabolism.

Nutritional imbalance is associated with **oral diseases** including dental decay, gum disease and oral cancer. **Nutritional deficiencies** can lead to abnormal appearances of the oral soft tissues.

NUTRITION AND DENTAL DECAY

Dental decay is the most common oral disease to affect humans. It has the potential to cause dental **abscesses** and severe **infections**. These dentally-related infections can **endanger the airway**, and without treatment will lead to **tooth loss, destruction of the jaw bone**, and may result in hospitalisation for the treatment of **life-threatening infections** that can endanger the airway.

Dental decay results from the **ingestion of sugar** in the presence of **oral bacteria** and **teeth**. In the absence of adequate oral hygiene the teeth will grow a thick film of dental plaque that consists of millions of bacteria, many of which ferment the sugars producing acid. The tooth surface is then subject to acid-attack with resulting demineralisation of the tooth surface, followed by cavity formation and breakdown of the tooth structure. If the decay is allowed to progress it will eventually reach the pulp in the centre of the tooth (the nerve and blood vessels) leading to inflammation of the pulp tissue causing pain, pulp death and infection with abscess formation.

The impact of sugars on dental caries

Sugars include glucose (refined from carbohydrates and present in most processed foods), fructose (found in fruit), sucrose (found in foods and beverages) and lactose and galactose (both found in milk and milk products such as cheese and yogurt).

We often refer to sugars as either intrinsic or extrinsic. *Intrinsic sugars* includes sugar molecules within the cellular structure of the food (fruits, vegetables and grains) and *extrinsic* involves sugar molecules outside the

cellular structure of the food and are therefore added to the food in processing, preparation or at the time of consumption.

While all sugars must be considered potentially cariogenic (causing dental caries), those that are intrinsic and those natural to milk are less cariogenic than the extrinsic sugars added to our foods by the food manufacturers, food preparers and the consumer. Sugars can be intrinsic in foods including honey, syrup, and fruit juice but these too are cariogenic and can add to weight gain with little or no health benefits and can cause decay.

The foods containing intrinsic sugars (fruit, vegetables, grains, milk and milk products) also have other health benefits including the delivery of calcium necessary for bone health and fibre that is necessary for gut health and for a healthy “microbiome” (the natural mix of health-related bacteria found in our gut).

Guidelines on sugar consumption

In Australia, the health guidance on sugar intake recommends limiting the intake of all food and drinks containing added sugar such as confectionary, sweetened drinks including soft drinks, cordials, fruit juices, vitamin waters and sports drinks.

Impact of other foods on dental caries

The consumption of rapidly digestible starch (RDS) has significantly increased the risk of dental caries in all age groups. The slowly digestible starches (SDS) appear to have no adverse effect on dental caries rates. The SDS are found in natural foods such as whole grains, fruits and vegetables.

Remineralisation of early decay

Japanese research in elderly patients investigated the long-term effect, over 6 years, of milk and milk products on the development of root surface decay.

Findings: It was found that the greater the intake of milk and milk products the less root decay developed. It was suggested by the researchers that an adequate intake of milk and dairy products such as yoghurt and cheese have a protective effect against root decay mainly attributed to their remineralising effects.

This preventative effect of milk relates to the modern use of ToothMousse and ToothMousse Plus that uses technology associated with Casein (milk protein) and phospho-peptides and amorphous calcium phosphate (CPP-ACP) to re-mineralise areas of tooth surface damaged by the demineralising action of plaque-related acid.

This is a product used increasingly to “heal” early lesions of decay particularly in children and in the elderly with root decay.

The process of remineralisation is one that is not new. It is the reason why fluoride toothpaste is advised for all patients. The topical effect on teeth has the benefit of reducing the incidence of dental decay by strengthening the tooth enamel.

In the same way, as fluoride toothpaste delivers fluoride to the teeth, so does the regular drinking of fluoridated tap water. Drinking fluoridated water is supported by dietary advice guidelines in Australia and NZ where everyone should be encouraged to drink plenty of tap water as most water is fluoridated. This topical

effect of the fluoride strengthens the enamel surface of teeth by the conversion of the hydroxy-apatite in the enamel to fluor-apatite.

Further advice concerning the use of sugar-free chewing gum should be given as it encourages the production of saliva that contains enzyme systems and further encourages re-mineralisation of the teeth. The saliva also clears sugar residues from the mouth, lubricates the soft tissues and helps prevent erosion of teeth, maintain soft tissue health and prevents infections including fungal infections, particularly in denture wearers.

NUTRITION AND PERIODONTAL DISEASE

Research has been conducted on several food types to assess any impact on periodontal disease (saturated fatty acids, antioxidants, lipids, vitamins, fibre). From the many studies reported, high intake of saturated fatty acids was significantly associated with greater prevalence of periodontal disease.

Deficiencies in both vitamins C and D have been shown to be associated with increased risk of gingivitis and periodontitis. This is unsurprising as they are intimately linked with the synthesis of collagen, required for healthy tissues around the teeth (bone, periodontal ligament and the gingiva (gum)).

A diet rich in antioxidants, which includes the vitamins c & D and poly-unsaturated fatty acids, high fibre foods (fruits and vegetables) appear to have a protective effect on the initiation and progression of gum disease by their immuno-modulating effects reducing oxidative stress of the periodontal tissues thereby reducing inflammation.

NUTRITION AND ORAL CANCER

The consumption of fresh vegetables and fruit is associated with a reduction in the risk of oral cancer while the converse is true of preserved vegetables (salted, dried, fermented and pickled). There is little reliable evidence for any other nutritional relationship.

Evidence has been presented for a link between drinking very hot teas in China, Japan and Korea, and the incidence of oesophageal squamous cell carcinoma in men, although other risks factors may well be involved including alcohol intake.

NUTRITION AND OTHER ORAL CONDITIONS

One obvious association that exists is that between dietary acids and acid erosion of the teeth.

Nutritional deficiencies in micronutrients such as iron, folate, vitamins B12 and vitamins A, C and D have been shown to be related to a number of other oral conditions including:

- Dental developmental abnormalities including reduced quantity of tooth enamel
- Salivary gland atrophy with reduced function
- The abnormal formation of the lips and palate in utero leading to clefts of the lip and palate
- Oral fungal infections including thrush (oral candidiasis)
- Sore and red tongue with loss of the surface papillae (glossitis), recurrent oral ulcers and infections at the corner of the mouth (angular cheilitis) and generalised soreness of the mucosa of the mouth (mucositis)
- Development of oral lichen planus that is a potentially pre-malignant condition.

Nutritional deficiencies are avoidable if a balanced diet consisting of plenty of natural foods including vegetables of different colours, fruits, grains, fish, meat, nuts and plenty of water.

It is not uncommon for individuals on fad diets to develop nutritional deficiencies (low-carb, keto, vegan) where some food groups may be restricted by the person's choices of foods within the restricted dietary choices.

Children, pregnant women and lactating mothers are also at risk of micronutrient deficiencies. This is due in part to their higher requirements for a number of nutrients. Most clinical features of micronutrient deficiencies may manifest in the oral and peri-oral region, a dentist may well be the first healthcare professional to detect such disorders.

IMPLICATIONS FOR DENTISTS

Dentists are trained in, and have an obligation to offer advice on nutrition and oral health to their patients.

With the constantly emerging evidence on the intimate relationship between oral health and general health, and their broad training that covers not only dental information including dental pathology, dental microbiology and nutrition, but also general medical subjects including general pathology, systemic physiology of the body, general pharmacology and medical microbiology, the dentist is the ideal person to work at the interface of dental diseases and medical conditions.

Increasingly evidence is being presented for a unique relationship between oral disease, in particular gum diseases (gingivitis and chronic periodontitis) and general medical diseases including coronary artery disease, stroke, diabetes, chronic kidney disease, dementia/Alzheimer's disease, premature birth, low birth weight babies).

Nutritional advice should promote the consumption of all types of fruit and vegetables (unpreserved), nuts and seeds and whole grain starch-rich foods. They should also promote restriction of the intake of foods and drinks containing free sugars (confectionary, sugar-sweetened beverages, soft drinks, cordials, fruit juices, vitamin waters and energy or sports drinks. The regular intake of tap water is to be strongly encouraged particularly where the water is fluoridated, and the consumption of milk and milk products are also beneficial for dental and general health.

Preserved vegetables (salted, dried, fermented or pickled) are considered to be detrimental to our general health. Foods high in fats especially saturated fats and high levels of salt are also to be discouraged.

SUMMARY

- Nutrition is associated with oral disease and plays a central role in the cause and progression of dental decay through dietary sugar intake
- Naturally occurring sugars (intrinsic) to fruit, vegetables, grains, and milk sugars (extrinsic) found in milk products are less cariogenic and have some health benefits.
- Added (free) sugar are highly cariogenic. They consist of mono- and di-saccharides added to foods by the manufacturer, cook or consumer and those sugars present in honey, syrup and fruit juices are also extremely cariogenic.

- Sugar is important in diet in terms of quantity, frequency and form (sticky or non-sticky) in the cause of dental decay.
- The WHO promote the restriction of free sugars to 5-10% of daily intake.
- There is limited evidence that Vitamins A and D, polyunsaturated fatty acids, slowly-digested starches, high fibre food (fruits and vegetables) may have a protective effect on periodontal disease.
- There is some very limited indication that the intake of vegetable and fruits reduce oral cancer risk.
- There is some evidence that preserved vegetables are associated with increased oral cancer risk.
- Dental erosion is related to acidic dietary intake.
- Micronutrient deficiencies are associated with forms of anaemia and oral soft tissue changes.
- Dental practitioners may be the first healthcare professionals to have the opportunity of seeing oral changes that may indicate systemic diseases or nutritional deficiencies.
- Dentists have an obligation to offer preventative advice and nutritional advice to their patients to promote oral and general health.