Diet and dental caries

Preventive Dentistry
Fifth Grade
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Sucrose

Dietary sugars all diffuse into plaque rapidly and are fermented to lactic and other acids or can be stored as intracellular polysaccharides by the bacteria, but sucrose has more cariogenicity than other sugar types. It has been called the arch - criminal in dental caries.

The epidemiological evidence for sucrose as the cause of dental caries

- Low caries prevalence in population with low sucrose intake
- The decline in caries prevalence during wartime with sucrose shortage
- The rise in caries prevalence with increasing availability of sucrose
- Archeological evidence of low caries prevalence in areas before sucrose became freely available
- Low caries prevalence in disorders of sucrose metabolism (hereditary fructose intolerance).

Sucrose refined from sugar canes or sugar beets is the most common dietary sugar and is largely responsible for the effect of sugar which favor colonization by oral microorganisms and increase the stickiness of the plaque, allowing it to adhere in large quantities to the teeth.

Starch and dental caries

Starch constitutes a heterogeneous food group, it varies in botanical origin, it may be highly refined or consumed in its natural state, it may be consumed raw or in a cooked form. All these factors should be considered when assessing the cariogenicity of starches.

Starch foods such as rice, potatoes and bread are of low carioganicity in human. Uncooked starch has very low cariogenicity.

The starch granules in plants are only slowly attached by salivary amylase because the starch is in an insoluble form and protected by cellulose membranes. Heating at temperatures used in cooking and backing, however, causes a partial degradation to a soluble form, which can be further broken down by salivary and bacterial amylase to maltose, malt triose, dextrin and small amounts of glucose.

Addition of sugar to cooked starch lead to increase of the cariogenicity of foods, such as sweetened breakfast cereals, sweet biscuits, cakes and cookies.

1. Physical form of food and clearance time

In addition to the chemical composition of food, physical and organoleptic properties (particle size, solubility, adhesiveness, texture and taste) are important for cariogenicity, since they influence eating pattern and oral retention of foods. Diet that results in the greater retention of refined carbohydrate over the longest period are the most cariogenic.

- The carbohydrate in various drinks are eliminated within 5 minutes while sweets such as sugar containing chewing gum, toffees and lozenges generally give high oral sucrose concentration and clearance time from 40 minutes for chewing gum to 15-20 minutes for other sweets.
- The texture of the diet is also important, for both salivary secretion and elimination of fermentable carbohydrate from the oral cavity. A diet that require thorough chewing will result in the secretion of high amount of saliva with a high pH and strong buffering

capacity, in contrast to finely textured diet that require little mastication tend to be retained in the oral cavity and eliminated slowly.

2. Factors in the diet that protect against dental caries

Food and food components that have anticariogenic properties are sometimes referred to as "cariostatic factors". Fluoride is the most effective of these factors. However, dairy products, plants foods, tea and even chocolate contain factors that protect against caries. Other factors are:

Phosphate

The possible caries inhibiting effect of various phosphate, which are found naturally in many foods. The most promising of the organic phosphate was phytate, identified as the most active substance in unrefined cereals. The effectiveness of phytate appears to be due to its ability to adsorb readily and firmly to enamel surfaces and so prevent the dissolution of enamel by acids. Phosphates are anticariogenic and appear to be most effective. Phosphate exhibit their anticariogenic action via local factors like:

- ❖ Reduction of enamel solubility
- ❖ Buffering effect in neutralizing salivary plaque
- ❖ Rendering fats, carbohydrates and proteins which are less cariogenic
- ❖ Interference with enzymatic process on enamel surface to increase host resistance
- ❖ Decrease in bacterial adhesion
- ❖ Interference with synthesis of extracellular polysaccharide formation
- ❖ Maintenance or increase of plaque calcium and phosphorous level.

Other inhibitors like pyridoxine, fat, tannic acid, constituents of coca, butter are believed to have caries protective factors.

Fat

Fat seems to reduce cariogenicity of food through different ways:

- They may act merely by replacing carbohydrate in the diet.
- Fat may also form a protective barrier on the enamel, or surround the carbohydrates, making them less available and speeding up their removal from the mouth.
- Bacterial surface properties involved in plaque formation could also be altered by fats.
- Certain fatty acids have antimicrobial effect and have been shown to inhibit glycolysis in human dental plaque.

Fruit and dental caries

Fruit and vegetable contain more non-starch polysaccharides and plant cell wall materials that benefit health. It is preferable to consume whole fresh fruit as opposed to juice, because their mastication provide a good stimulus to salivary flow. In addition, fresh juices contain non-milk extrinsic sugars since liquidation release the fruit sugar from the cellular structure of the fruit. There is little evidence from epidemiological studies in humans that consumption of fruit is associated with the development of caries and induced negative correlation between fruit consumption and dental caries have been reported.

Milk

- Human breast milk: which one of the main sources of sugar in the diet of small children, normal milk consumption does not cause

dental caries. It contains higher lactose (7%) and lower phosphorous (15 mg/100 g) and calcium (34 mg/100 g) than cow's milk.

- ❖ Cow's milk: contain lactose (4-5%), which is less acidogenic than other sugar, and also contain calcium (125 mg/100 g), phosphorous (96 mg/ 100 g) and casein, all of which are cariostatic (prevent enamel demineralization).

Milk rich with calcium and phosphate which act by:

A. Reducing the rate of dissociation of hydroxyl apatite
B. Reducing the fall in pH by buffering acids produced by fermentation.
C. Enhancing remineralization.
D. Modifying formation and composition of pellicle and plaque.

Cheese

Numerous animal and experimental studies have indicated that cheese is anticariogenic because it stimulates salivary secretion and increase plaque calcium concentration which strongly influences the balance between de- and remineralization of enamel.

Plant foods

It contains organic phosphate, inorganic phosphate and phytate. The organic phosphate protect the teeth by adsorbing onto the enamel, forming a protective coat, also inorganic phosphate have been found to be effective cariostatic and prevent demineralization of enamel. Phytate is anticariogenic and act by adsorbing onto the enamel surface to form a

physical barrier that protects against plaque acids. Also plant foods (fibrous foods) stimulate salivary flow. Saliva not only help to clear food debris from the mouth, but also buffer plaque acid, and therefore, favor remineralization of tooth enamel. (on animal studies only but human studies have not produced convincing results).

Chocolate

It contain theobromide which is able to increase crystal size in enamel, thus increasing the resistance to demineralizing acids. However, the high sugar content of chocolate outweighs these potential effects.

Tea and apple

Apples contain polyphenol (which have antibacterial action) and are good stimulus to salivary flow.
Tea contain polyphenol in addition to fluoride and flavonoid.

Black tea extracts have been shown to inhibit salivary amylase activity and reduce dental caries.

3. Intake frequency

Greater the intake frequency of cariogenic food, greater the susceptibility to decay. Frequent snacking in between meals increase the duration of time for which plaque pH remains below the critical value (5.2-5.5) and thus greater demineralization attacks on the teeth.

4. Chemical composition

Carbohydrates are classified as monosaccharide, disaccharide and poly saccharides. Sucrose which is a disaccharide consisting of fructose and

glucose is more easily fermentable than polysaccharide as starch. Earlier it was thought that consumption of sugar mainly sucrose was the key factor in the development of dental caries. But processed cooked starchy foods, especially when combined with refined sugar (doughnut, pastry, potato chips) also contribute to dental caries.