Review Article

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Chewing Gums: From Evolution To Revolution

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Abstract

Diet affects the integrity of the teeth; quantity, pH, and composition of saliva; and plaque pH. Dental plaque, which develops naturally on hard tissues of mouth, through complex ecosystem intraorally. Studies have shown a correlation between the acidogenic potential of a food and changes in the pH of human dental plaque following the ingestion of that food. Chewing sugar-free gums promote strong flow of stimulated saliva, which aid in rapid oral clearance of sugars; second, the high pH and the buffering capacity of the stimulated saliva help to neutralize plaque pH after a sugar challenge. Today, more than 50 percent of Chewing gums are sweetened with sugar substitutes such as polyol sweeteners, artificial sweeteners or both. Study results have shown that oral bacteria do not use these sugar substitutes to produce acids that demineralize enamel and dentin. thence, the following review is an attempt to provide an insight to various poplyols and their proposed mechanisms and their potential benefits.

Keywords: Polyols; Chewing Gums; Xylitol; Sorbitol.

Introduction

"An ounce of prevention is better than a pound of cure." Dental caries is one such disease which can be prevented if appropriately diagnosed [1]. Diet effects the integrity of the teeth; quantity, pH, and composition of saliva; and plaque pH [2]. A dynamic relation exists between sugars and oral health. Diet affects the integrity of the teeth; quantity, pH and composition of saliva; and plaque pH. Dental plaque, which develops naturally on oral tissues, is one major action of this complex ecosystem. Studies have shown a correlation between the acidogenic potential of a food and changes in the pH of human dental plaque following the ingestion of that food [3]. Food containing higher amount of carbohydrates and sugars will leave the mouth with an acidic pH. Sugary snacks given an hour after a meal will bring the pH of the mouth back down to an acidic level and bacteria will begin to thrive and produce more acid. It does not give the mouth time to recover from the acid overload and the mouth remains acidic for most of the day. This gives bacteria plenty of time to produce acidic waste and demineralize the teeth [4].

Chewing sugar-free gums promote strong flow of stimulated saliva, which helps to provide a number of dental benefits: first, the higher flow rate promotes more rapid oral clearance of sugars; second, the high pH and the buffering capacity of the stimulated saliva help to neutralize plaque pH after a sugar challenge.

Today, more than 50 percent of Chewing gums are sweetened with sugar substitutes such as polyol sweeteners, artificial sweeteners or both.

The global market for chewing gum is estimated to be 560,000 tonnes per year. Approximately 374 billion pieces of chewing gum are sold globally every year; representing 187 billion hours of gum chewing if each piece of gum is chewed for 30 minutes. Chewing gum can thus be expected to have an influence of oral health [5].

History of Chewing Gums

Is dated back in 50 AD, when the Greeks sweetened their breath and cleansed their teeth by using mastiche, a resin from the bark of mastic tree

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(masticate is derived from the root word mastiche). The ancient Mayan Indians of Yucatan chewed tree resin (chicle) from the sapodilla tree. Spruce gum became the first chewing gum to be manufactured commercially as "State of Maine Pure Spruce Gum" in 1848.

The first patent for chewing gum was filed by William F Sample (1869), a dentist from Mount Vernon, Ohio. This was initially intended to be used as a dentifrice. William Wrigley Jr. launched his first chewing gum (Lotta and Vassar) in the 1890s, followed by Juicy Fruit and Wrigley's Spearmint gum [6].

Sugar- Free Chewing Gums

Sugarless gums were introduced in early 1950s with Sorbitol used as sugar substitute. The first brand to be marketed was Harvey's followed by Trident and Carefree in 1975. W. Wrigley Jr. introduced Freedent , designed especially for denture wearers, which do not stick to the dentures [6].

Polyols

Polyols, a group of versatile, reduced-calorie sweeteners, can be used to reduce the calories and reduce or replace the sugar in a variety of foods and beverages. Their use is increasing due to the unique health and functional benefits that these bulk sweeteners offer for food production and design. Of particular importance, polyols do not promote tooth decay. Polyols have fewer calories that sugars and, when used alone or with intense sweeteners, food and beverages sweetened with polyols may be labeled "tooth friendly" or "does not promote tooth decay."

Polyols are a group of low-digestible carbohydrates, which are similar in structure to sugar molecules, except for the substitution of a hydroxyl group in place of the aldehyde or ketone group found on sugars.

They are also used in toothpastes, mouthwashes and pharmaceutical products, such as cough syrups and throat lozenges [7].

There are Eight Polyols in General Use

Erythritol, Hydrogenated Starch Hydrolysates (HSH) (Also Known As Polyglycitol, Maltitol Syrup Or Polyglucitol), Isomalt, Lactitol, Maltitol, Mannitol, Sorbitol And Xylitol.

Benefits of Polyols

- Also known as sugar alcohols and are considered as sugar substitutes.
- They are listed as sugar alcohols, but they do not contain ethanol, which is found in alcoholic beverages.
- Large amounts (usually more than 50grams) can have laxative effect, causing bloating, intestinal gas and diarrhea.
- Polyols serve as useful alternatives to sugars in a wide range of products including chewing gums, candies, ice creams, baked goods and fruit spreads.
- In addition, they function well in fillings and frostings, canned fruits, beverages, yogurts and tabletop sweeteners.
- In addition to providing sweetness, polyols can help retain moisture in food products, lower water activity to help protect against spoilage, impart smoothness and creaminess by inhibiting sugar crystallization, provide viscosity, and assist in retaining flavor at high temperatures.
- They are reduced in calories and do not cause sudden increases in blood sugar levels [8].
- Importantly, polyols are not readily converted to acids by bacteria in the mouth and, therefore, do not promote tooth decay. Plaque formation is low as polyols do not provide a substrate for the production of extracellular polysaccharides [8].
- In October 2010, the European Food Safety Authority's (EFSA) Panel on Dietetic Products, Nutrition and Allergies (NDA) adopted two opinions related to sugar free chewing gum and reduction of tooth demineralisation and the neutralisation of plaque acids [1,2,9].
- In April 2011, EFSA's NDA Panel further substantiated health claims regarding the positive effects related to the consumption of polyols and dental health. After a review of research on the consumption of polyols and maintenance of tooth mineralization, the Panel concluded, "The consumption of foods/drinks containing xylitol, sorbitol, mannitol, maltitol, lactitol, isomalt and erythritol, instead of sugar in sugar-containing foods/drinks, may maintain tooth mineralization compared with sugar-containing foods, provided that such foods/drinks do not lead to dental erosion [10]."

Sorbitol

- The most commonly used bulk sweetener.

- It is found naturally in fruits and berries [11].
- 60% as sweet as sucrose, much less expensive than xylitol [12].
- Less effective than xylitol in controlling caries.
- In small amounts, it does not lower the pH of plaque to a point where enamel demineralization occurs [13].
- Considered as low cariogenic rather than non-cariogenic one because consumption of larger amounts increases both the acid production in plaque and the number of sorbitol-fermenting bacteria [14].
- Chewing sorbitol sweetened gum for about 5mins after receiving a sucrose rinse has been shown to substantially reduce demineralization [15].
- Salivary stimulation from sorbitol sweetened gum is also thought to promote remineralization [16].
- Both xylitol and sorbitol can be broken down by certain strains of lactobacilli thereby reducing pH sufficiently to dimineralize enamel [17].

Xylitol

The first trials for xylitol were conducted in the late 1960s and early 1970s in Turku, in Finland [18].

- Salivary mutans streptococci counts drop with consistent use of xylitol sweetened gum, probably because replacing sucrose with xylitol "starves" the cariogenic microorganisms [19].
- Consistent use of xylitol sweetened gum reduces plaque accumulation [20].
- Trials that compared the groups of subjects that chewed xylitol sweetened gum, sorbitol sweetened gum and gum with xylitol-sorbital mixtures for the duration of 40month trial. The results demonstrated that the gum that was most effective in preventing caries was a 100% xylitol sweetened gum. Gums sweetened with xylitol-sorbitol mixtures were effective though less than 100% xylitol sweetened pellet [21].
- Since 1963, the U.S Food and Administration has approved xylitol for use in special dietary food.
- It is more expensive than sucrose and sorbitol, and it cannot be used in cooked food products because it is destroyed by heat.
- Commercially produced from plants such as birch and other hard wood trees.
- Occurs naturally in many fruits, vegetables and is even produced by te human body during normal metabolism.

Mannitol

- 50% as sweet as sugar.
- Found naturally in mushrooms and trees.
- Used as a dusting powder for chewing gum products [22].

Maltitol

- 90% as sweet as sugar.
- Has half the calories of the sugar.
- Useful in the production of sweets, including sugarless hard candies, chewing gum, chocolates, baked goods and ice-cream [22].

Erythritol

- Occurs naturally in fruits such as pears, melons and grapes as well as foods such as mushrooms.
- Also found in fermentation-derived foods such as wine, soy sauce and cheese [23].

Hydrogenated Starch Hydrolysates

- They serve in a number of functional roles such as bulk sweetener, adding viscosity or body to foods and serving as sugar free carriers for flavors and colors.
- Produced by the partial hydrolysis of corn, wheat or potato starch [22].

Isomalt

- Unique amongst all the sugar substitutes because it retains almost all the physical properties of real sugar.
- On addition of water, it does not become sticky which is an added benefit to the sugar artists, cake decorators and pastry cheffs [23].

Lacitol

- Used as a bulk sweetener in calorie-controlled foods.
- It has similar taste to sucrose and can be used in a variety of low-calorie, low-fat and/or sugar – free foods such as ice-creams, chocolates, hard and soft candies, baked goods, sugar preserves, chewing gums and sugar-substitutes [23].

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