PRACTICAL PROBLEMS IN USE OF SUGAR SUBSTITUTES IN PREVENTIVE DENTISTRY

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ABSTRACT
Sugar substitute often act as a food additive that gives a sweet taste similar to that of sugar containing significantly less food energy than sugar-based sweeteners, producing it a low-calorie sweetener. Artificial sweeteners also referred to as sugar substitutes or high-intensity sweeteners. Artificial sweeteners may act in so many foods, drinks, drugs, and hygiene products that has some argue that every people of Western countries probably uses it. Because they are so sweet and in less need to sweeten foods so that fewer calories are added. There is availability of a variety of safe sugar substitutes to benefit it to consumers as it enables food manufacturers to formulate a variety of good tasting sweet foods and beverages which are safe for the teeth as well as for general health.

INTRODUCTION
The importance of diet in the development of caries has been suspected in the distant past as the process has always shown to be multifactorial nature, also paid a major role sugar in the diet leading to the disease and it has been generally accepted worldwide.

However the oldest period of recorded history, man has always suspected that the process of the dental decay is related to the type of food he consumed.

Aristotle expressed his view that dental caries was caused by consumption of sweet figs that struck to the teeth. As a result of that more than 23 centuries had elapsed, and we are still lacking any ultimate information concerning the relative cariogenicity of specific food composing the human diet.

On the other hand as per human taste preference for sweetness, it is doubtful that many patients will voluntarily confined their sugar consumption permanently in order to reduce dental caries. A more realistic approach may be offer sucrose substitutes in the diet that has harmful side effects. In order to be used it in a wide variety of foods, such substances should not only be sweet but also in many instances they also provide calories in in large amount.

The professionals have the fortunate to advice the importance of diet and role of sugars in caries formation. It is crucial that the dentist must be familiarized to the people with the alternatives of sugars and the types of food products that are available in the market with substitute sweetening agents. The classification of new safe, palatable, non-low caloric sweetener substitutes for the more cariogenic sugars such as sucrose, glucose, fructose and maltose continue to be actively required for use in the food performed areas. Reviews on relationship between sugar and dental caries are summarized by numerous researchers as follows: Concept of sugar substitutes

The relationship between the incidence of sugar consumption and dental caries has been well documented. Thus, the professionals impart an interest in the search for safe sugar substitutes. The following factors prompted for the search of sugar substitutes related to dental health are as follows:

The attempt to convince the patients to follow the special dietary programs to limit the occurrence with which sugar-

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containing food are ingested could not be achieved for the anticipation of caries on a public health extent. Animal trialling clarified many concept of cariogenicity of sucrose relative to other dietary components that lead to the detection of caries that is a sucrose-dependent infection involving Streptococcus mutans. The explanation in the human have associated S. mutans with dental decay and generally which favours the sucrose S. mutans interactions observed in the animal models.

As the appearance of S. mutans appears to be sucrose dependent, then tactics which reduce sucrose availability in the plaque ecosystem that comprise effective preventive method in carries control. Interferences between meal and sucrose bioavailability can be most easily gained by the use of sugar substitutes, and this provides the rationale for deterrence through their use.

The Turku sugar study conducted in Turku showed that xylitol was non-cariogenic and anti-cariogenic when substituted from sucrose either in foods or in chewing gums whereas the xylitol food study was a 2-year clinical trial in which it showed that young adults volunteers consumed food sweetened with sucrose, fructose, xylitol. The xylitol group exhibited at the end of the study about an 85-90% drop in caries score compared to the sucrose group.

Cariogenicity of S. mutans is based upon a pH optimum showing critical pH for enamel demineralization. So, one well known can concurrently discriminate against S. mutans and promote enamel remineralization by procedures that prevent or minimize acid production in the plaque.

In this view the use of sucrose substitutes becomes an attractive tactic for the control prevention of dental caries. The latent approach was first realized by the remarkable 80% reduction of caries relative to a sucrose control observed within xylitol chewing gum in the Turku study.

**Difficulties In The Substitution of Sucrose**

There has been substantial reasons for the replacement of sucrose by other sweeteners, but such changeover is not at all simple. If condition of the product is to taste as sweet as the conventional sucrose product, but it is sweetened with alternative sweeteners, then the change of sweetener may lead to changes in the recipe.

If the dry properties of sucrose is replaced fully by the new sweetener, the product differs from the sucrose product not only in sweetness, but often in many other properties as sweeteners has different physical and chemical properties.

Sucrose is an unusually adaptable sweetener, useful in many different types of products. If sucrose has to be replaced for health purpose by a “new sugar” it is possible that a single sweetener is not able to fulfill all the roles of sucrose in the in many other products.

The sweetening strength of glucose, lactose, and maltose syrup are insufficient to sweeten food products. Saccharin and Cyclamate has some bitter aftertaste although both are non-caloric sweeteners, the energy content of food products, other than beverages, cannot be reduced using these sweeteners, as good, non-caloric baking agents, as alternatives do not exist.

**Reception of Sugar and Sugar Substitutes by the Public Sector**

In view of the fact that the key elements of acceptance are those used by food technologists and market researchers in the design of new products. Similarity to sucrose taste is only one of several factors.

The important ones are legality, price, stability, utility in product classes which the ease of advertising the advantage of the product to the consumer, and the ability to induce a purchase drive through advertising.

Saccharin can substitute for the taste of sugar; but only lactose can substitute for the browning function of sucrose, and none of them can substitute for sucrose in all of its uses. While many of these uses are trivial to the function of sucrose in foods, even it is wrong to think that sugar in foods can be simply substituted by replacing it with artificial sweeteners like saccharin and cyclamate.

The term “artificial sweetener” is a poor one and fails to differentiate nutritive from non-nutritive sweeteners. However, it is used because it is commonly employed and sometimes useful to have a term sufficiently imprecise to cover both intensive sweeteners and bulk sugar substitutes that may not even be sweet.

In the beverage field it is clear that artificial sweeteners created new products which were additional to the sugar-sweetened products, and not competitive with them. Similarly introduction of “sugar less” chewing gum increased the total chewing gum market size without decreasing the consumption of sugar gum. The point remains that per capita consumption of sugar has been stable for generations, in spite of the use of saccharin, cyclamate, and now aspartame.

**Factors Influencing Intend of Sweet Tasting Foods**

Sweetness alone is an insufficient depiction of that quality of sugar substitutes providing hedonic satisfaction. Many compounds are naturally sweet in their own right as their descriptive terms are usually based on approximating the sweet taste of sucrose.

**Cooling**

The cooling properties of dextrose is an insufficient hedonic extra to balance the lack of sweetness of dextrose vis-à-vis sucrose, but the cooling effect of xylitol which is as sweet as sucrose, have a definite product advantage in certain food types.

**Bitterness**

Bitterness seeming in a sweetener, is generally considered a negative trait leading to decreased acceptance, but in an appropriate product may lead to increased acceptance. For example Saccharin can give more distinct fruit flavors, or can be hidden in bitter products.

**Licorice taste**

It perceived as a long-lasting, back-of-the-throat licorice-like sweetness, is invariably regarded as a product deficiency, as in glycyrrhizin products. Thus it limits the utility of the dehydrochalcones, and many other extremely intense sweetening agents.
**Potential Effect of Salivation on Acceptance**

Salivation experiments are often carried out in difficulty even with chewing gum. The consciousness of producing saliva for measurement greatly affects the output. As common experience illustrates, that sugar is initially released very rapidly in the first minute of stimulated chewing, with a gradual tapering off in its release for the next 3-5 min.

Although this information is incomplete, it at least suggests that gelatin desserts as eaten might also end up as 10% sucrose in saliva; and perhaps all sweet products end up near the “bliss point” on eating. If sugar substitute has to match not only the desired sweetness but the functionality of sucrose, then solution rate of saliva production will produce a bolus of food near the “bliss point.”

For dental reasons, awareness of salivation properties of sweeteners is as distinct from their sweetness properties as needed. As long as the bulk of sugar substitutes are in aqueous solutions of intense sweeteners, it is perhaps not a matter of prime concern. But if we wish to move sugar substitution beyond diet in soft drinks into the realm of real foods—where the bulk of sugar is to be found—then perhaps sugar substitutes should be examined as much for their salivation efficacy as taste efficacy.

It would be satirical to move to sugar substitute which is much less effective than sucrose in promoting salivation, since saliva is undoubtedly the major defense against the oral threats posed by the diet.

It should be noted that the plaque pH value has been shown to correlate with saliva flows induced by test foods; and that the plaque pH value given by a sugar coated cereal was found to be higher than that given by the uncoated version. The reason appears to be that the saliva flow induced by the sugar coating, by virtue of increased buffer and plaque washing effects, more than compensates for the glycolytic effect of the higher sugar concentration.

**Factors Related to age and Denture Wearing**

**In Sweetness Acceptance**

Many studies have shown that age per sec does not seem greatly to affect taste acuity, at least for men, and neither does the wearing of dentures, as judged by measuring sensitivity when using standard test solutions for the four salt, sour, sweet, and bitter tastes.

The need of food recognition is said to be the most frustrating characteristic of denture wearing. Food manufacturers are acutely aware of the contact of sweetness with other organoleptic modalities and strive to put out balanced products. But for denture wearers, this balance point will be mistaken for many foods, and they may attempt to restore it by restoring to the only flavor stimulants readily available, i.e. Salt and sugar. Increased salt consumption could clearly be a health concern, and increased sugar consumption might be a health concern even beyond oral hygiene for some groups (e.g. unrecognized diabetics) even if fewer susceptible teeth are at risk.

**Latent Psychological Stress Factors**

The biggest use of sugar substitutes is made without concern for teeth or though undeniably some dental benefit is obtained, in the manufacture of drinks or other calorie-controlled foods.

Sum study that motivates those who consume them may have important points to promote the use of artificial sweeteners for foods causing less dental harm.

Many dieters are highly motivated as the largest users of artificial sweeteners. Often psychologists use the term “Cognitive dissonance” which describe stressful psychological processing of data, the kind a person would prefer not to process at all.

The conviction of Chinese for the health benefits of sugar for the liver; the fear of cancer from saccharin, the desire for “natural” foods; the drive to be young, healthy, active, attractive, diabetes and decayed teeth reflects knowledgeable, from a wide variety of sources capable of modifying the direct response and thus the acceptance of any sweetener.

**Possible Physiological Factors**

Physiological responses to sweetness, as well as sweeteners, cannot be neglected in acceptance considerations. Therefore studies have shown that preventive responses, due to gustatory clues, can be seen not only in saliva flow but also in gastric and pancreatic secretions.

Known fact of Insulin resulting from oral stimulation by sugar affects the later gastric response making is less acute and long lasting. Sucrose in the mouth also affects the glucose level in the liver. Saccharin works as well as sugar in the oral stimulation of insulin, and works as well as the taste of oil in modifying blood triglyceride levels produced by fatty meal.

In some manner, taste primes the digestive process and important digestive effects due specifically to sucrose (or fructose) in affecting liver function cannot be ruled out. Quite possibly, biochemical responses to a sweetener may be learned and associated with sweetener type, and its acceptance thereby affected, whether the effect is direct (as with the digestive discomfort caused by polyols) or taste mediated.

**Satiety Properties on Acceptance**

Every product, has its own individual capacity to generate a specific acceptance. We can thus only predict the prior consumption of artificially sweetened products, no matter how well sweetened, it will not affect acceptance of later sucrose-sweetened products.

The research suggests that he entire range of sugar products would need to be reformulated with artificial sweeteners; to form the uniformity throughout all foods would ensure that acceptance would not be stimulated by any one of them. Every flourishing features seem in fact to be based on this principle.

**Disarticulation Effect of Sugar Substitutes on Sucrose Usage in Foods**

The obtained data accumulated for many years do not support to the idea that massive use of sugar substitutes has yet had any depressing effect upon the per capita consumption of sugar.
In the infusion field it is clear that artificial sweeteners created new products which were additional to the sugar sweetened products, and not competitive with them. Therefore, introduction of “sugar less” chewing gum increased the total chewing gum market size without decreasing the consumption of sugar gum.

The point remnants that that consumption of sugar has been stable for decades, in spite of the use of other sweeteners. However, the use of corn-based fructose syrups has endangered to replace all sucrose in regular beverages as the result of the availability of a cheaper sweetener which is indistinguishable in taste.

The substitution effect, exists, has yet to be seen for a non-fermentable sugar substitute. If it does occur, it will be much more likely to affect the fructose syrups being used in beverages than sucrose itself.

Public Health Significance
Polyols are hydrogenated carbohydrates used as sugar replacers. They are less-cariogenic, low glycemic (equally helpful in diabetes and cardiovascular disease), low-energy and low insulinemic (potentially helpful for obese), slow-digestible (helpful in the colon), osmotic (act as laxative and purifying) carbohydrates.

Future Perspectives of Sugar Substitutes
It is now an well-known fact that sugar definitely contributes to formation of dental cavities. Thus, to prevent dental caries sugar consumption needs to berestricted. However, in view of human taste preference for sweeteners, it is unlikely that many people will voluntarily confine their sucrose consumption permanently in order to reduce dental caries. Hence, there is a need to replace dietary sugars with substances which provide sweetness but lack the cariogenic effects. For this reason various investigators have searched for alternative sweeteners or sugar substitutes i.e. sugar substitutes have marked their role in the dental industry also, they are being frequently used in toothpastes, mouthwashes, mouth fresheners and chewing gums. The future trend also includes introducing sugar substitutes in dental floss and toothpicks. However, the use should be with limitation analyzing fully their side-effects.

CONCLUSION
The substantiation for casual relationship between sugars and dental caries has been established. Dental caries still remains a very valuable and widespread disease that in many industrialized countries affects mainly disadvantaged individuals and is of serious concern in many developing countries. Use of sugar substitutes in preventive dentistry is gaining importance. At the same time it faces some practical problems in satisfying several favorable properties of sugar (sucrose).

Availability, taste preference, physiochemical properties and most importantly their cost and public perception are few areas which influence their acceptance by public. Replacing sugar with a suitable substitute to combat dental caries is an option wide open. Recent studies suggesting antimicrobial properties as well as less cariogenicity of some sugar substitutes such as xylitol is encouraging.

References