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Chewing Gums a Boon or Bane to Dental Health - A Review

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Abstract: Chewing gum has evolved from a recreational confectionery product into a potential adjunct for maintaining oral health. In recent decades, considerable attention has been directed toward sugar-free chewing gums containing sweeteners such as xylitol and sorbitol because of their ability to stimulate salivary flow and influence the oral microbial environment. Increased saliva production contributes to improved buffering capacity, clearance of food debris and enhanced remineralization of enamel. Novel formulations containing casein phosphopeptide–amorphous calcium phosphate (CPP–ACP) have further expanded the preventive potential of chewing gum by providing bioavailable calcium and phosphate ions that support enamel repair. In addition, medicated and nicotine-containing chewing gums have been developed as alternative delivery systems for therapeutic agents. Evidence from laboratory, clinical and community-based studies suggests that appropriately formulated chewing gums may contribute to caries prevention, reduction of cariogenic bacteria and maintenance of oral health when used alongside conventional preventive measures. This review summarizes the composition, mechanisms of action, therapeutic applications, and oral health benefits of various chewing gum formulations currently available.

Keywords: *Chewing Gum, Oral Health, Xylitol, Sorbitol, CPP–ACP, Remineralization, Medicated Chewing Gum.*

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I. INTRODUCTION

Chewing gum is a widely consumed product that has evolved from a simple confectionery item into a potential adjunct for oral health promotion. Pharmaceutical chewing gum is generally defined as a chewable dosage form designed to release active ingredients gradually during mastication without being swallowed.[1]

The practice of chewing resinous substances dates back thousands of years and has been documented in numerous ancient civilizations. Modern chewing gum formulations have undergone substantial development, particularly following the introduction of sugar substitutes and therapeutic additives. A major advancement occurred in the 1970s with the introduction of xylitol-containing chewing gum, which attracted attention because of its potential role in reducing dental caries.[1]

Chewing gum influences the oral environment primarily through stimulation of salivary flow. Increased saliva production enhances buffering capacity, promotes clearance of food debris, supplies minerals necessary for enamel repair, and contributes to maintenance of oral homeostasis. In addition to these physiological effects, several formulations now incorporate active ingredients such as xylitol, sorbitol, fluoride, chlorhexidine, calcium phosphate compounds, and other therapeutic agents intended to improve oral health outcomes.[2]

Because of these developments, chewing gum has gained interest as a supplementary preventive measure in dentistry.[2] This review examines the composition, mechanisms of action, therapeutic applications, and oral health implications of various chewing gum formulations currently available.

II. HISTORY AND BACKGROUND

The use of chewable natural substances predates recorded history. Ancient populations, including Egyptians, Mayans, and Native Americans, chewed plant resins and tree exudates for enjoyment, oral cleansing, and breath freshening. Commercial production of chewing gum began in the nineteenth century, with one of the earliest marketed products being spruce-based gum introduced in the United States in 1848.[2]

The scientific and commercial interest in chewing gum expanded considerably during the twentieth century. Initial formulations relied heavily on sucrose as a sweetening agent, which limited their value from a dental perspective because frequent exposure to fermentable carbohydrates contributes to caries development. The introduction of polyol sweeteners such as sorbitol and xylitol represented a significant turning

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point, allowing manufacturers to produce sugar-free products with improved oral health profiles.[2]

Today, sugar-free chewing gum constitutes a major segment of the global chewing gum market. Research over several decades has demonstrated that these products can stimulate saliva production and may contribute to the prevention of dental caries when incorporated into routine oral hygiene practices.[3]

➢ *Composition of Chewing Gums*

Chewing gum is made of gum base, sweetening, flavoring and aromatic agents. The gum base is a mixture of elastomers, natural and/or synthetic resins, fats, emulsifiers, waxes, anti-oxidants, and fillers. Natural elastomers have been replaced today by synthetic ones such as poly isobutylene and butyl rubber[2].

Table 1 Typical Composition of Sugar-Free Stick and Pellet Chewing Gum Formulations

Ingredients	Sugar free stick formulation (%)	Sugar free pellet formulation (%)
Sugar substitutes	40-60	20-40
Gum base	18-30	20-35
Gylcerol	5-20	3-10
Coating agents	-	2-5
Flavours	<2.5	<3
Artificial sweetners	<0.3	<0.3
Preservatives	<200mg/kg	<200mg/kg
Lecithin	<0.2	-
Coloring agents	-	<0.35

The primary oral health benefit of chewing gum results from increased salivary secretion. Saliva helps neutralize acids, remove food debris, buffer plaque pH, and provide calcium and phosphate ions necessary for enamel remineralization. These effects collectively reduce the risk of demineralization and support oral health maintenance.[4]

III. SUGAR-FREE CHEWING GUMS AND ORAL HEALTH

➢ *Sorbitol*

Sorbitol is one of the most frequently used polyol sweeteners in sugar-free chewing gum. Compared with sucrose, sorbitol has a lower cariogenic potential because it is metabolized slowly by oral bacteria. Clinical studies have demonstrated reductions in caries incidence among children regularly chewing sorbitol-containing gum. Although sorbitol is less effective than xylitol in suppressing cariogenic microorganisms, it remains a cost-effective and safer alternative to fermentable sugars.[3]

➢ *Xylitol*

Xylitol is a naturally occurring five-carbon sugar alcohol extensively studied for its anticariogenic properties. Unlike sucrose, xylitol cannot be readily metabolized by cariogenic bacteria, thereby reducing acid production and limiting bacterial growth. Long-term clinical trials have shown reductions in dental caries and mutans streptococci levels among regular users. In addition to its antibacterial effects, xylitol stimulates salivary flow and supports enamel remineralization. Consequently, xylitol-containing chewing gum is considered one of the most effective sugar-free chewing gum formulations for caries prevention.[4]

➢ *CPP-ACP and Remineralization*

Casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) is a milk-derived compound that stabilizes calcium and phosphate ions in an amorphous state. These ions become readily available during acidic challenges, helping to reduce enamel demineralization and promote remineralization.[5]

Several clinical and laboratory investigations have demonstrated that CPP-ACP-containing chewing gums increase salivary calcium and phosphate concentrations, improve mineral uptake by enamel, and support the repair of early enamel lesions. When combined with fluoride, CPP-ACP may further enhance remineralization and strengthen the protective effects of fluoride therapy.[6]

➢ *Medicated and Nicotine Chewing Gums*

Chewing gum has also emerged as an effective drug-delivery system. Medicated chewing gums can provide both local and systemic therapeutic effects through absorption across the oral mucosa. Advantages include rapid onset of action, improved patient compliance, avoidance of first-pass metabolism, and ease of administration without water. Nicotine chewing gum is one of the most successful examples of this technology. It has been widely used as a smoking cessation aid by delivering controlled doses of nicotine to reduce withdrawal symptoms and cravings. Clinical studies have shown improved quit rates when nicotine gum is combined with behavioral counseling and support.[7,8]

IV. DISCUSSION

Growing scientific evidence suggests that chewing gum can play a supportive role in maintaining oral health when used appropriately. The benefits are derived not only from the act of chewing itself but also from the active ingredients incorporated into modern formulations.[9]

Among sugar substitutes, xylitol has received the greatest attention because of its ability to interfere with the growth and metabolism of cariogenic microorganisms. Regular exposure to xylitol-containing products has been

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associated with lower levels of mutans streptococci, reduced plaque accumulation, and a decreased risk of enamel demineralization. In addition, the stimulation of salivary flow during chewing enhances natural buffering mechanisms and supports remineralization processes within the oral cavity.[9]

Sorbitol-containing chewing gums also provide advantages compared with conventional sugar-containing products. Although sorbitol may be fermented by certain oral microorganisms under specific conditions, its cariogenic potential is substantially lower than that of sucrose. Consequently, sorbitol-sweetened chewing gum remains a practical alternative for reducing exposure to fermentable dietary sugars.[3]

The incorporation of CPP–ACP technology into chewing gum has further expanded the preventive applications of these products. CPP–ACP serves as a reservoir of bioavailable calcium and phosphate ions, helping maintain mineral saturation in saliva and dental plaque. This mechanism may assist in repairing early enamel lesions and reducing mineral loss during acidic challenges. Several experimental and clinical studies have reported favorable outcomes related to remineralization and caries prevention.[10]

In addition to preventive dentistry, chewing gum has emerged as a useful platform for drug delivery. Medicated chewing gums offer advantages such as patient convenience, prolonged contact with oral tissues, avoidance of first-pass metabolism for certain drugs, and rapid onset of action. These characteristics have encouraged the development of formulations containing nicotine, analgesics, antiemetics, and other therapeutic agents.[11]

Despite the encouraging findings reported in the literature, chewing gum should be viewed as a complementary measure rather than a replacement for established preventive strategies. Effective plaque control, fluoride exposure, dietary modification and regular dental care remain essential components of oral health maintenance.[12]

V. CONCLUSION

Chewing gum can serve as more than a confectionery product when formulated with scientifically validated ingredients. Sugar-free chewing gums containing xylitol and sorbitol stimulate salivary secretion, improve oral clearance mechanisms and contribute to a less cariogenic environment. Among these sweeteners, xylitol demonstrates additional benefits through its influence on cariogenic microorganisms and its ability to support enamel remineralization. CPP–ACP-containing chewing gums further enhance preventive strategies by supplying calcium and phosphate ions that assist in repairing early enamel lesions.[12]

Medicated chewing gums also represent a convenient delivery system for selected therapeutic agents. Although chewing gum should not replace routine oral hygiene practices, current evidence supports its use as a valuable adjunct to tooth brushing, fluoride exposure, and professional dental care. Future well-designed clinical studies are needed to further clarify long-term benefits and optimize recommendations for different patient populations.[7]

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