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# FACTORS RESPONSIBLE FOR DENTAL CARIES AMONG PATIENTS AND ITS MANAGEMENT

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**Abstract**

*Dental caries is defined as the acidic byproducts of bacterial fermentation of carbohydrates that damage dental hard tissues. For the majority of people, it is a chronic condition that advances slowly. This is due to an ecological imbalance in the relationship between oral biofilms (plaque) and tooth minerals. The structure of the teeth dissolves because it frequently occurs in the dental hard tissues. It frequently presents in the hared tissues of teeth and dissolves the teeth's structure. A major problem with oral health is dental caries. It is the most frequent chronic pediatric disease and the main reason why kids lose their teeth. Risk factors include pypoplasia and hypopasia. The incisors are mostly affected, followed by the canines, upper second molars, and primary molars. Bacteria produce lactic acid from fermented food; it has the ability to disintegrate the tooth's hydroxyapatite crystal structure.*

*Sucrose is the main caries causing contributor, and high sugar intake raises the risk of dental caries. The primary component of dental enamel and dentin is hydroxyapatite, which was created by bacteria during the demineralization process. Utilizing organic ingredients in treatments to prevent dental caries may result in reduced expenses, but clinical trials and in vivo toxicity research are still needed Probiotics, herbal and spice extracts, antimicrobial treatments, Dental caries has been treated and prevented with fluoride, chlorhexidine, quaternary ammonium salts, and antimicrobial peptides (AMPs). Fluoride alone does not prevent caries, but careful consumption of sugary foods and maintenance of a balanced diet are essential for controlling dental plaque. Individual oral hygiene practices should be encouraged to reduce free sugar consumption and manage dental plaque to prevent dental caries and periodontitis.*

**Keywords:** *Antimicrobial, Caries, Dental, Factors, Hygiene, Peptides*

## INTRODUCTION

The significance of maintaining good dental health to overall health has long been recognized. In particular, dental caries is one of the most common diseases in the world and a chronic infectious disease associated with biofilms that is a concern for global public health. Dental caries are defined as the localized acidic byproducts of bacterial fermentation of dietary carbohydrates that cause damage to sensitive dental hard tissues. For the majority of people, it is a chronic condition that grows slowly (1). This is due to an ecological imbalance in the relationship between oral biofilms (plaque) and tooth minerals. It frequently happens in the dental hard tissues and causes the structure of the teeth to dissolve. Nearly all adults and 60 to 90 percent of school-age children, according to the World Health Organization, have dental caries (2). Dental caries causes widespread infection as a result of microbial invasion (3). Hygiene issues, tooth physiology and strength, saliva pH and host immunity which adds to the financial burden and decreases the quality of life (4).

When the acid reaches an area of vulnerability on a crystal surface where impurities and inclusions of other ions (especially carbonate ions) incorporated in the crystal lattice produce defects and calcium-deficient regions, calcium, and phosphate are dissolved and transferred into the surrounding aqueous phase between the crystals (5). Cavitation will eventually form if the diffusion of calcium, phosphate, and carbonate

out of the tooth is allowed to continue without the proper remineralization. Remineralization helps subsurface; non-cavitated carious lesions heal naturally. It is a process where calcium and phosphate diffuse into the tooth from topical sources like saliva or other bodily fluids and, with the aid of fluoride, build upon leftover crystals that already exist rather of forming new ones. The original crystalline surface was substantially more vulnerable to acid attack than the recreated one; this is composed of a fluorapatite-like mineral veneer that is well-formed. This is a result of fluoride being present. (6).

## PRIMARY CARIES

A primary caries is one that develops on a previously healthy tooth surface. Primary dental caries affects several upper tooth surfaces. The lesion first appears on the proximal surface and progresses to the deep contact area of the teeth. Pit and fissure caries are confined phenomena that also arise on the occlusal surface. The caries which spread in all dimension of the tooth along with enamel prisms. Caries that manifest in teeth without restorations are referred to as primary caries. Lesions around the edges of repaired teeth are referred to as secondary caries.

## SECONDARY CARIES

Recurrent caries and secondary caries might occasionally be confused. Although secondary caries are new caries that develop at the edges of a restoration, recurrent caries are new caries that are found below dental restorations. In the vicinity of damaged fillings or faulty restorations, secondary caries or recurrent caries can develop. Dental decay that develops rough or chipped may gather more plaque and eventually turn into a risk factor for secondary decay. In the Secondary caries the lesion has to appear at the margin of a dental restoration. These are lesion on the margin along with the cavity which may be signs on demineralization and micro-leakages. However, According to microbiological research, the repair beneath this leakage does not significantly demineralize (7).

## GLOBAL SCENARIO OF DENTAL CARIES

Along with oral pharyngeal malignancies and oral tissue lesions, dental caries is one of the most significant issues with oral health (8). Over 2.43 billion people, or 36% of the world's population, have dental caries that harm their permanent teeth. 9 percent of the population, or over 620 million people, experience this problem with their baby teeth. The disease is most prevalent in South Asian, Middle Eastern, and Latin American countries, and is least prevalent in China. Dental caries, which are at least five times more prevalent than asthma in the US, are the most prevalent chronic paediatric illness (9). Between 29% and 59% of individuals over the age of fifty develop dental caries, making it the main pathological cause of tooth loss in children.

## EARLY CHILDHOOD CARIES

Early childhood caries is decay found in young children with their decious teeth. Early childhood caries (ECC) is the incidence of dental caries in young children and is defined as one or more deteriorating, missing (due to caries), or filled teeth in the primary dentition in children up to 71 months of age. All teeth can be damaged; however, the maxillary anterior teeth are the most commonly affected. Children who are allowed to go to bed with feeding cups, bottles, or several feedings of sweetened beverages during the day are more likely to develop this type of caries (10).

## RAMPANT CARIES

Rampant caries are more serious decays that affect numerous teeth's many surfaces (11). People with xerostomia, often known as dry mouth, a condition that is frequently encountered at dentist clinics, are more likely to experience it. The most frequent reason is the use of certain systemic drugs, which puts elderly people at more risk because they typically take more medications, as well as poor cleanliness habits. Drug-induced dry mouth and a high-sugar diet have stimulated this condition (12). The radiation-induced caries are the results of previous radiation to the head and neck of tooth. When new teeth erupt, the issue is also seen during the self-destruction of roots and total tooth desorption.

## CORONAL CARIES

Coronal caries is type of infection on where the plague is present, biofilm is permitted to grow and form on crown surfaces. However, it is frequently linked to approximations of places, pits, and fissures. The dietary fermented carbohydrates increase the high amount of bacteria, and these carbohydrates are fermented by organisms which are forming plague. These carbohydrates are in responsible of producing acids like lactic acid. This acid production lowers the pH in the area, which encourages the microbial community to switch to acid-tolerant bacteria for example, *mutans Streptococci* Furthermore; *Streptococcus* is a highly acidophilic organism. This pathogenic organism is capable of producing a high amount of acid and lowers the pH up to 4.5 pH. This acidic pH can inhibit the growth of other organisms within the bio-film (13).

## ROOT SURFACE CARIES

As the name indicates root surface caries affect dentine or root cement. It is brought on by biofilm-forming bacterial colonies. Since the healthy mouth and dentine are not exposed to the microorganisms, this infection is secondary. Consequently, it cannot be colonized. There are many factors involved in root surface infection such as old age, injuries, periodontal treatment and excessive brushing, but the most common factor is old age. Lack of daily tooth brushing and flossing is poor oral hygiene. Too much tooth brushing force or the use of a toothbrush with strong bristles is considered aggressive. Age: As people get older, their gums usually recede and expose the root surfaces. Periodontal disease, sometimes referred to as gum disease, deepens periodontal pockets and causes soft tissue to recede, allowing plaque and germs access to tooth roots. Genetics: Weak tooth enamel, age-related gum recession, and periodontal disease frequently run in families. Diabetes - can make gum disease more severe and challenging to treat as well as weaken the immune system and promote soft tissue inflammation. Misaligned teeth make it harder to completely clean your teeth and can raise your risk of gum disease. Using tobacco and smoking cigarettes the infection causing pathogens in root is different from the crown even though it is still plague technically (14).

## DENTAL CARIES ETIOLOGY

Dental caries arises when sugars and other fermentable carbohydrates from the diet are anaerobically metabolised by bacteria in dental plaque, demineralizing the hard tissues of the teeth, the enamel and dentin. Organic acids make calcium hydroxyapatite more soluble in dental hard tissues, and calcium loss causes demineralization of the tooth surface. According to recent searches, an intricate interaction between acid-producing microbes and fermentable carbohydrates causes dental caries (15). moreover, the oral micro flora influence the formation of dental caries and as well as host factors are involve including teeth, saliva which leads to the chronic or slow progressive infection. A vital component in the etiology of caries is the dental micro flora. The risk factors which are involved in caries are complex matrix, transfer of resistant genes and physical protection techniques provided by EPS (Extra pyramidal side effects) multiple research studies demonstrate that managing the dental bio-film is essential for preventing dental caries. (16). Furthermore, rests of the other challenges are lack of obvious targets for treatment and poor retention of local administration (17).

## EPIDEMIOLOGY OF DENTAL CARIES

According to a recent survey, dental caries still present significant challenges in terms of treatment and prevention (18). According to archaeologists, dental caries in human's dates back to roughly 3000–12000 BC. According to historical records dating back to 5000 BC, caries was first linked to "tooth worms" in India, Egypt, Japan and China (19; 20). In the resent studies the data is showed the prevalence and untreated caries are about 21.3%, based on calculated sample represented 193.5million adults of united state (21). In the Asia region the dental caries are in the most common uncommunicable. The infection shows strong prevalence rate in poor and disadvantaged populations, which is generally having low access to prevention, care and rehabilitation. More than 900 million cases of dental cares were estimated in 2019 along, with sever periodontal and edentulism (Edentulism is the state of being edentulous, or without natural teeth). Furthermore, it is estimated that about 43.8% and 135 million people having untreated deciduous caries. The prevalence rate of periodontal caries is about 20.8% and 307 million cases and the 4.1/52.7 million case of

edentulism (22). Dental caries is a significant issue for dental public health in Pakistan. In Pakistan, it was shown that 60% of the population had dental caries (23).

## STAGES OF DENTAL CARIES

The mineral matrix of the teeth is destroyed by pathogens in dental plaque, including bacteria and fungi. Dental caries manifests as white, chalky spots on the tooth in its earliest stages, while the tooth's surface is still intact and reversible. Early indicators of caries are the white patches on your teeth, which can be recognised from developmental hypocalcification, which happens when your tooth enamel lacks enough calcium. Weak and thin enamel develops as a result of this deficiency. Your teeth appear chalky and opaque due to hypocalcification, which can also cause yellowing, whitening, or discolouration. Moreover, white sport can change in to black staining stage. Unfortunate, when surface of the tooth broken or cavitated due to acid challenge and lose of mineral then at that time lesions cannot be reversed. We can differentiate stages of caries on the basis of lesion colors such as usually, golden brown lesions are indicating the active stage of infection, and darker on nearly black lesions are long or chronic stages. Tooth decay occurs in five phases: demineralization, enamel decay, dentin decay, pulp damage, and abscess. Demineralization occurs when plaque bacteria cause tooth enamel to lose minerals, causing small white patches. Enamel decay is the second stage, with white patches becoming brownish and more enamel and mineral loss. Dentin decay, located beneath tooth enamel, is more vulnerable to deterioration due to its softer nature and potential for nerve damage. Pulp damage, which contains blood vessels and nerves, can cause discomfort, swelling, and heightened sensitivity. Early pulp injury is treatable and reversible, while later pulp damage may require extraction or root canal therapy. Abscess, caused by bacteria spreading and multiplying inside the tooth, can cause severe swelling and pain. Treatment options include medications and tooth extraction. A bad indicator of severity is the depth of colour. Sometimes the darkest decay is chronic (24).

## SIGNS AND SYMPTOMS OF DENTAL CARIES

Caries symptoms and signs vary depending on where and how severe they are. When the cavity is only acute, there can be no symptoms. As the decay progresses over time, it may result in toothaches, mild to severe pain while eating or drinking anything sweet, sour, or bitter (25). However, it’s possible that tooth decay won't hurt. Nevertheless, if you have dental caries, you could develop: toothache - either a continuous pain that keeps you up at night or an infrequent, severe pain that doesn't have a clear cause of tooth sensitivity - you might feel soreness or pain when you eat or drink something that's hot, cold, or sweet. You may observe brown, black, or grey patches on your teeth due to tooth discoloration poor breath. Visible holes and pits appears on teeth, brown black stains appear on teeth, bad breath and bad taste, fever, chills abscess and truisms (26).

## PATHOGENESIS OF DENTAL CARIES

Dental caries are influenced by a number of factors, including the host, bacteria, and food. Caries develop when pathogenic or acid-producing bacteria and food fibers colonise sensitive teeth. Lactic acid, which bacteria make from fermented food, can damage the hydroxyapatite crystal structure of teeth, leading to caries (27). Sucrose is the main caries causing contributor for instant many oral bacteria such as *Streptococcus* having extracellular enzymes. Which may split sucrose's -1 and -2 glycosidic bonds and use the energy so that they can generate fructose and polymers (mutans and glucans) .Glucosyltransferases (GTFs) are a collective name given to this set of enzymes. The synthesis of glucan-mutan polymer in this particular connection between caries and sugar allows the bacteria to assemble into biofilms and reach a critical mass. Without reaching a critical mass, the bacteria would colonise the oral cavity but not in sufficient numbers to damage the enamel surface. In addition, the critical mass is biologically responsible for man's recent caries epidemic and is specifically related with glucosyltransferases and sucrose. Because microorganisms use sugar to generate an environment with a low pH that de-mineralizes teeth, high sugar consumption increases the risk of dental caries (28). as metabolic byproducts of fermentable carbohydrates, weak organic acids are produced in the bio-film (dental plaque). The acids would demineralize the tooth tissue by causing the local pH to drop

below a threshold level. The primary component of dental enamel and dentin, hydroxyapatite crystals, is hydroxyapatite, which was created by bacteria during the demineralization process. These crystals diffused into the teeth through the water between them. The bacterial profiles vary between primary and secondary dentitions and fluctuate according to the disease condition. Other bacterial species, such as those from the genera *Veillonella, Lactobacillus, Bifidobacterium,* and *Propionibacterium,* as well as low-pH non-*S mutants streptococci*, *Actinomyces spp.*, and *Atopobium spp.*, are also probably key players in the development of caries.

## ROLE OF SMOKING ON DENTAL CARIES

Smoking and tooth cavities are closely related, according to epidemiological studies. One of the key elements in the development of caries is bacteria. Because of the imbalance between commensal and cariogenic bacteria in dental plaque, more acid is produced, which can destroy dental hard tissue. Bacterial changes in the oral cavity are being brought on by smoking. More than 100 multiple types of bacteria inhabit the oral cavity, and they prefer to colonise the oral mucosa and the hard structures of the teeth (29). Many of them are in symbiotic relationships with their hosts. These oral bacteria serve as a barrier to the harmful organisms' invasion. Due to the exposure of bacteria in cigarettes, which are made from tobacco plants, many bacterial profiles can be found in smokers (30). Examples include *Bacillus, Pseudomonas, Lactococcus, Streptococcus, Clostridium, Enterobacter, and Aspergillus* (31, 32). Furthermore, there are many harmful chemicals used in cigarette smoke, such as *benzene, ammonia, tar, cadmium, which* can be produced during the usage of tobacco or may be part of the tobacco itself (33; 34). Because oral surfaces are often the first to come into touch with tobacco when someone smokes, the toxic chemicals in tobacco have the potential to harm the mucosal tissues and other oral cavity components. Moreover when the oral dysbiosis occurs it will leads to the oral infections such as dental caries and periodontitis. Smokers have a weak immune system, and chemicals in smoke can lower the neutrophil's activity. Neutrophils play a vital role in both the initiation of inflammatory responses and the immune system's defense mechanism (35).

## ROLE OF DENTAL CARIES ON DIABETES TYPE I AND TYPE II INDIVIALS

A common chronic illness that can result in hyperglycemia is diabetes mellitus (DM), oral mucosal illnesses, dental caries, periodontal disease, and dysfunctional saliva. Diabetes-related insulin shortage may cause hyposalivation and higher levels of salivary glucose, the accumulation of glucose in your saliva can also be brought on by high blood glucose levels. This glucose can fuel dangerous bacteria, which in turn combines with food to build plaque, a soft, sticky coating that causes cavities. This may increase the risk of tooth decay in diabetic individuals. Saliva composition plays a significant role in determining the prevalence of caries and oral health because it protects against immunologic bacterial, fungal, and viral infections, preserves the integrity of oral tissues, and regulates the balance between demineralization and remineralization in a cariogenic environment. The most cariogenic bacteria include *Lactobacillus* and *Streptococcus mutans*, which can lead to a low pH environment that promotes the development of dental caries. A powerful way to track oral problems in diabetes mellitus is to analyse dental caries, salivary components, and bacterial pathogens in saliva simultaneously (36). According to studies, diabetic patients' rates of dental caries were 78.9% in India (90), 84.49% in Pakistan (91), and 67% in China (92).

## ROLE OF GENETIC MAKEUP ON DENTAL CARIES

There is evidence supporting the idea that dental caries can be run in families or inherited through generations. Genetic factors have been shown to contribute to the development and progression of dental caries (37). One of the many complex dental illnesses caused by inherited, environmental, and pathogenic microbial factors is dental caries. Dental caries is a dynamic, reversible process that is caused by the interaction of numerous etiological variables, some of which promote demineralization while others help remineralize minerals

The microbial makeup of your body can be strongly influenced by your genetic makeup because some genes might increase your susceptibility to certain diseases while others can protect you from them. Dental caries is a complicated condition that combines germs, a cariogenic diet, and a susceptible host. For instance,

HLA genes affect the host's immunological response. It is connected to *Streptococcus Mutans* oral colonisation. Susceptibility for the onset of MS. While sharing a home, family members follow the same eating and oral hygiene routines. Calculating heritability estimates aids in estimating the genetic influence on phenotypes. Broad-sense and narrow-sense heredity are the two types of heritability.

Broad -sense heritability examines the contributions of various genetic variations to phenotypes, whereas broad-sense heritability examines the entire genetic contribution to phenotypic determination. While additive effects underline the genetic influence of a parent's genes on a child's traits, non-additive effects emphasis genetic dominance and gene-gene interactions. Some genes have been linked to a higher chance of acquiring dental caries, according to a study. For example, the gene encoding Mucin 5B (MUC5B) has been linked to increased susceptibility to dental caries. Other studies have identified variations in genes involved in the immune response and enamel formation, which can also affect the risk of developing dental caries (38).

## ROLE OF ENVIRONMENT ON DENTAL CARIES

Environmental factors that affect the risk of developing dental caries include food, oral hygiene routines, and fluoride exposure. This influence cannot be discounted. Dental caries is considered to be a dietary-microbial disease that needs to form a cariogenic biofilm as well as regular exposure to fermentable carbohydrates (glucose, fructose, maltose, and sucrose) in the diet. Additionally, social, psychological, and behavioral factors have a significant role in the progression of the illness. Since it is well recognized that fluoride can stop tooth decay, inadequate fluoride exposure should be taken into account as a risk factor for the spread of the illness. However, the presence of genetic predisposition may increase the susceptibility to dental caries even in the presence of good oral hygiene and a healthy diet (38).

## ROLE OF SOFT DRINKS IN DENTAL CARIES

Soft drinks are manly made up of sugars and inherent acids both of them having acidogenic and carcinogenic potential. Many researches have showing the positive relationship between dental caries, dental erosion and soft drinks (39). Accordingly clinical examinations the infections of teeth caused by soft drinks are resulting in erosion and caries. The early stage of infection reported as dental erosion including smooth surface. While on advance stages may appear as canactivies of enamel, lesions with longer depth than width. It also shows undulated borders, intact borders along with facial gingival margins (40). Consuming soft drink a lot may also cause health issues as well as caries and erosion (41). There are some certain slowly processing caries which suddenly becomes rampant (42). Soft drink consumption in excess has been linked to significant dental caries, including erosion. Additionally, the histological appearance of the illnesses varies. Dental hard tissues may suffer if these two diseases are present at the same time. Acid is created when the sugar in soda reacts with oral microorganisms. The teeth are attacked by this acid as well as additional acid from soft drinks. Each acid attack lasts for around 20 minutes, and each sip triggers a new assault. Acid erosion that is constant weakens tooth enamel. When tooth enamel is destroyed, cavities develop. Bear in mind that even "sugar-free" or diet sodas contain an acid that might damage your teeth. Fruit drinks include acid and sugar that can lead to tooth damage even if they aren't carbonated like soda. Patients should be given the suggestions that follow in order to prevent dental erosion and cavities as well as to make them aware of the adverse effects of excessive soft drink use. restricting soft drink use, selecting low erosive soft drinks, changing one's drinking habits, cleaning teeth at least twice daily, refraining from brushing immediately after eating acidic foods, and using fluoride or remineralizing toothpaste are all ways to prevent tooth decay.

## ROLE OF DIET ON DENTAL CARIES

Habit of diet intake has a local and systemic effect on the overall oral cavity. Dietary changes can have an impact on the health of the teeth, the surrounding tissues, the bones, and the healing process for wounds. Tooth erosion is continues lose of hard tissue by acids, gastroesophageal reflux, diet regurgitation and sounding environment (43). It is caused by eating problems, poor dietary habits, and acid production in the mouth by bacteria. Numerous modifying factors, such as saliva, the immune system, time, socioeconomic status, education, lifestyle selections, and fluoride use, have been identified. Caries can develop when

demineralization has taken place and the pH decreases to 5.5. When the pH of plaque increases, mineral redisposition (remineralization) takes place. The protective effect of fluoride is achieved by reducing the critical pH by 0.5 pH units. However, a lesion will develop depends on the balance between tooth demineralization and remineralization, the latter of which occurs far more slowly than the former. Diet and nutrition can affect this balance in a number of different ways. The low pH that results makes it easier for acidogenic and aciduric bacteria (*mutans Streptococci*) to proliferate. On the other hand, remineralization may be facilitated by a diet rich in calcium-rich cheese and low in added sugars and fermentable carbohydrates. Sucrose makes it easier for *mutans streptococci* to colonise teeth and develop there (44, 45).

## ROLE OF SUGAR ON DENTAL CARIES

Refined sugars, carbonated drinks, and fruit juices are supposed to be responsible for causing dental caries. The ability of a carbohydrate to cause cariogenesis depends on how effectively oral bacteria use the glycolytic route to break it down, which affects how acidic dental plaque becomes. While starch must be broken down into simpler sugars in order to enter the glycolytic route, monosaccharides like glucose and fructose can enter the process directly. These carbohydrates are more cariogenic because they lead to a quicker and more significant pH reduction in dental plaque. Lactose, a milk sugar, has a lower pH drop and is hence less cariogenic. Table sugar (sucrose) is considered the most cariogenic sugar due to its pronounced pH drop and its role in oral microorganisms synthesizing extracellular and intracellular polysaccharides. Insoluble glucans facilitate bacterial adherence and increase plaque porosity, forming a "sticky" plaque. These polysaccharides can increase plaque formation and adhesion, prolonging acidification in plaque when no carbohydrates are available. Other factors known for causing dental caries include brushing frequency, time taken in consuming sugary food, frequency of consumption of sugary food, and smoking habit. No significant association between refined sugar among adults with and without caries is found. Though, it is a well-established fact among children that the greater the intake of refined sugar, the greater will be the incidence of dental caries (46:47:48:49). But the current study showed no such association among adults. The reason for this being most of the studies are focused more on identifying the cause of dental caries. Adults are more aware of the effects of refined sugar intake in causing dental caries and other health issues like diabetes, cardiac failure etc. That is why they avoid taking lots of refined sugar in their daily practice. The current findings are in line with many studies there is no significant association between dietary consumption of sweets, candies, sugar, or snacks and the development of new caries (50, 51). Furthermore, no linear or log-linear association existed between sugar intake and dental caries. The association was reduced to significantly or virtually absent when fluoride toothpaste was used twice a day (52).

## ROLE OF COFFEE ON DENTAL CARIES

Coffee chemicals have the ability to slow down bacterial adhesion and growth on tooth surfaces. Additionally, it can have an anti demineralization impact on the surface of the teeth. Furthermore, because coffee is generally safe and has a universally appealing taste and aroma, it opens up a viable field of application. In essence, coffee seeds are the coffea tree's dried seeds. Arabica coffee is the most frequently used and commercialized of the 80 various varieties of coffee. It is regarded as being more dignified and possessing good quality taste. In contrast to Arabica coffee, the coffea canephora family has a lower taste and more bioactive chemicals (53). They are prepared by extracting water from the ground and roasted seeds, giving them a texture, flavor, and color that are highly regarded globally (54, 55). There are different kinds of green coffee, and they vary depending on the species, agricultural techniques, primary/secondary processing, and storage procedures (53). Caffeine, trigonelline, chlorogenic acid, and diterpenes are all found in green coffee. Other components, like water, carbohydrates, lipids, and minerals, are comparable to other plants. This product has mono, oligo, and polysaccharides as its carbs (56). Coffee from the Caffine family is the most popular variety due to its pharmacological and physiological characteristics. This methyxanthine has an approximate concentration of (2.0g/100g) and is heat stable. Its content is half as high in Arabica coffee (1.0g/100g). Coffee's physiological benefits include activating the heart muscles, invigorating the central nervous system, and lowering drowsiness (56, 57). Despite their potential impact on human health, numerous

coffee chemicals have received inadequate research. Trigonelline is an alkaloid that is produced by the enzymatic methylation of nicotinic acid, which also results in the production of niacin, a B-complex vitamin. Approximately as much trigonelline is present in Coffea canephora (0.6g/100g) as in Coffea arabica (2.0g/100g). Trigonelline has reduced the spreading capacity of cancer cells in vitro while considering its potential bioactivity (58). Additionally, this compound has demonstrated in animal models the ability to rebuild dendrites and axons, indicating that it may enhance memory (59). Additionally, *Streptococcus mutans*, a cariogenic bacterium and a significant contributor to tooth dental cavities, has been seen as a target of its antibacterial properties (60). In general, it is believed that antimicrobial agents are the primary means of combating infections and disorders; nevertheless, overuse of these agents has been associated with an increase in the resistance of microorganisms against these same agents (61). and this may result in an unbalanced gut flora. Therefore, recent research on natural substances like coffee that have an antimicrobial effect against particular pathogens has supported the notion that it is important for medicine to develop novel treatments utilizing the mentioned products for the prevention and treatment of illnesses, including oral pathologies (62). One of the most frequent and extensive groups of compounds in flowering plants is the polyphenol family. Polyphenols have biological properties such as antioxidant, anticancer, and anti-inflammatory effects (63-65) respectively. The potential of polyphenols to inactivate bacterial toxins has also been widely reported as one of its antimicrobial activities (66). By producing hydrogen peroxide and changing the permeability of the microbial membrane, phenols such as catching have an antibacterial effect on a variety of bacterial strains from a variety of species, including *Escherichia coli, Bordetella bronchiseptica, Serratia marcescens, Klebsiella pneumonie, Salmonella choleraesis, Pseudomonas aeruginosa, Staphilococc* (66). Coffee contains polyphenols including caffeic acid and 5-caffeoylquinic, which have been shown to inhibit the growth of various *Enterobacteria* (68) *Legionella pneumophila* (67) *Streptococcus mutans* (69). These are the main bacteria involved in caries disease (70). Other organic chemicals, such as trigonelline, caffeine, and -dicarbonil compounds, have also demonstrated antibacterial activity against *Streptococcus mutans* in addition to polyphenols (71-73). However, opinions on the effects of caffeine have been divided. While decaffeinated extracts demonstrated decreased antibacterial activity against *Streptococcus mutans* compared to the corresponding non-decaffeinated extracts, several investigations found no antibacterial impact when simple caffeine was examined via susceptibility testing. (71). caffeine and the -dicarbonil chemicals in coffee work together to kill the same bacteria. Furthermore, Streptococcus mutans could be temporarily inhibited by caffeine at levels prevalent in beverages (0.5 mg/mL to 1.0 mg/mL), but a stronger and longer-lasting suppression required higher caffeine concentrations (72). additionally, the researchers found that the antibacterial action of Coffea arabica extracts improved when caffeine was added, indicating a synergistic effect. supporting the idea that coffee has antimicrobial properties (74). Inhibiting the tooth receptor's ability to engage with bacterial adhesions, the active compounds in coffee may bind to host surfaces, preventing both reversible and irreversible *Streptococcus mutans* adhesion to tooth surfaces. Considering the findings of the aforementioned investigations, coffee constantly exhibits antibacterial activity against *Streptococcus mutans*, which is an anti-caries effect. The anti-caries action of a drug has been linked to both its physicochemical effects, which block demineralization and promote remineralization processes, as well as its antibacterial effects, which interfere with *Streptococcus mutans* essential metabolic activities (75).

## ROLE OF BREST AND BOTTLE FEEDING ON DENTAL CARIES

The most prevalent chronic infectious illness in children is dental caries. The interaction of bacteria, primarily Streptococcus mutans, with sugary foods present on tooth enamel is thought to be the cause of dental caries. These microorganisms consume sugar to release energy, and as a result, they create an acidic environment in the mouth that erodes tooth enamel and causes dental caries (76). Early childhood caries (ECC), which is characterised as any sign of smooth-surface caries in children under the age of three, can be the result of a number of situations. A primary maxillary anterior tooth with cavitated, missing (from caries), or filled smooth surfaces, or one with a decayed, missing, or filled score of greater than or equal to four by age three, greater than or equal to five by age four, or greater than or equal to six by age four, can all indicate the development of ECC between the ages of three and five (77). Simple carbohydrates including lactose, sucrose,

and glucose are crucial substrates for cariogenic bacteria. Both breast milk and synthetic milk for babies, both of which contain approximately the same amounts of carbs, are fed to infants less than 12 months. Cow's milk, which has half as many carbs as Both breast milk and synthetic milk for babies, is typically introduced to children older than 12 months who reside in industrialized countries at that time (78-80). Each component is, however, also susceptible to risk factors, such as socioeconomic position, mother's level of education, maternal oral health, mother's smoking habits, mother's posture at birth, amount of sugar consumed, dental cleanliness, and fluoride exposure (80). Children who breastfeed for a longer duration of time had a lower risk of dental caries than those who breastfed for a shorter amount of time, according to meta-analyses. However, infants who breastfed for longer than 12 months, especially those who did so overnight, had an increased risk of tooth decay (81). Used to feed the infant, put him to sleep, and stop midnight crying for more than 18 months. Because none of these reviews compared bottle feeding to breastfeeding in connection to dental caries, it is unknown if bottle feeding is more closely associated with dental caries in primary dentition than breastfeeding. Since none of the reviews attempted to address this clinical question, it is still unknown if bottle feeding can lead to a higher risk of dental caries than breastfeeding fifteen years later. There is no higher risk of tooth decay when feeding for up to 12 months; Compared to manufactured baby milk, it can even be a protective element. The risk of tooth decay is higher in children who have breastfed for longer than 12 months while all of their deciduous teeth have already fully emerged. This can be the result of additional aspects of nighttime feeding without restriction. Avoiding additional cariogenic meals and inadequate oral hygiene practices were considered while comparing the results. Accordingly, According to WHO/UNICEF recommendations, breastfeeding should be promoted as the only feeding technique for up to six months, followed by supplemental breastfeeding for all children until they reach the age of two. Breastfeeding is also more effective than bottle feeding at preventing dental caries in early childhood. The pre-existing developmental abnormality of the enamel known as pypoplasia can also be used to establish the risk factor for early childhood caries. The term "hypopasia" describes the predisposition of teeth to early bacterial colonisation by strains such *Streptococcus mutans* and undernutrition. Due to the order in which the teeth erupt and the position of the tongue during feeding, the early childhood caries has a distinctive pattern. Due to the tongue's reduced exposure to swallowed liquids and the saliva's tendency to collect, usually, the teeth in the lower jaw are protected from infection. Caries primarily affects the incisors. The primary molars, upper second molars, and canines are also involved, depending on how long the caries process has been active (82).

## PREVENTION OF DENTAL CARIES

Both dental caries and periodontal diseases are preventable. Individual oral hygiene practices should be encouraged to promote a reduction in the consumption of free sugars and the effective management of dental plaque because dental caries and periodontitis are avoidable conditions. Professional tooth cleaning should be included in well-planned prophylaxis programmers that also include fluoride application, nutritional guidance, oral hygiene education, and motivation. Each patient should have a customized, risk-based prevention approach that is regularly implemented *(83).* An anti-caries impact of probiotic use along with the use of herbal and spice extracts (84). There is currently general agreement that fluoride is important when properly maintained in the oral cavity with regard to the prevention of this condition.

## THERAPEUTIC AGENTS FOR DENTAL CARIES

Utilizing a combination of natural products in therapies for the prevention of dental caries may result in reduced costs even though it has few adverse effects. Clinical trials and extensive in vivo toxicity research are still required. The study demonstrated an anti-caries impact of probiotic use along with the use of herbal and spice extracts (84). Antibiotics were widely used in the past to treat and prevent dental caries which showed some promise. In numerous literary works, the importance of systemic antibiotics such as tetracycline, penicillin, clindamycin, macrolides and metronidazole were emphasized. Aside from this Fluoride, chlorhexidine, quaternary ammonium salts, and antimicrobial peptides (AMPs) are examples of antimicrobial treatments that have been used to treat dental caries caused by oral bacteria (85, 86). There is currently consensus that fluoride is important when properly maintained in the oral cavity with regard to the

prevention of this condition. The dynamic demineralization process can only be influenced in this way, lowering the amount of minerals lost during demineralization and boosting remineralization. Thus, it can be concluded that fluoride alone does not prevent caries, with careful consumption of sugary foods and maintenance of a balanced diet being essential for the control of dental plaque (87).

Antibiotics were first employed systematically to treat and prevent dental caries, and this showed some promise. Penicillin, Tetracyclines, Metronidazole, Macrolides and Clindamycin were some of the systemic antibiotics that have been emphasized in various works of literature. Treatments for the prevention of dental caries may be less expensive and have fewer side effects if a combination of natural items is used. Clinical trials and significant in vivo toxicity studies are still required. The study revealed that probiotic use, along with the use of herbal and spice extracts, has an anti-caries impact, the systematic use of antibiotics to treat and prevent dental caries first showed modest promise (84).

The use of systemic antibiotics such Penicillin, Tetracyclines, Metronidazole, Macrolides and Clindamycin has been stressed in numerous literature works. To battle oral germs that cause dental diseases, several antimicrobial compounds have been utilized, including fluoride, chlorhexidine, quaternary ammonium salts and antimicrobial peptides (AMPs) (85, 86) . Chlorhexidine was demonstrated to prevent the development of bacterial biofilms and their proliferation (88).

There is currently general agreement that fluoride is important when properly maintained in the oral cavity with regard to the prevention of this condition. Only in this manner is it possible to affect the dynamic demineralization process, minimizing the amount of minerals lost during demineralization and promoting remineralization. Thus, it can be concluded that fluoride alone does not prevent caries, with careful consumption of sugary foods and maintenance of a balanced diet being crucial for the control of dental plaque (87). One of the most prevalent issues with dental caries chemotherapy is the difficulty of keeping the drug's minimum inhibitory concentration (MIC) in the oral cavity (89).

## CONCLUSION

Dental caries is a severe global issue caused by poor hygiene, poor awareness, and sugar-containing dietary products. *Streptococuus mutans*, an organism responsible for dematerializing tooth enamel fluoride, is a common cause of caries. Early childhood caries is more common due to unhealthy diets and consumption of wild foods. Proper bursting and less sugar-containing diets, along with proper awareness, can reduce the risk of caries. Coffee is a good source of reducing dental caries among the population. Drinking soft drinks and soda pops in moderation, especially with carbonation, is essential to prevent tooth decay. Use a straw when drinking and avoid carbonated beverages. Before bed, avoid soft drinks and fruit juice. Rinse mouths with water or brush teeth after using these substances. Regular dental cleanings and exams are essential for maintaining oral health. School-going children should clean their teeth daily after every meal. Regular dental visits are recommended, even if not experiencing any dental problems. Controlling diabetes is crucial for reducing other infections, including dental caries.

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