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Effect of Excessive Coffee Consumption on Dental and Oral Health

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ABSTRACT: Indonesia has the highest per capita coffee consumption in Southeast Asia, with 294,000 tonnes consumed. Coffee consumption can cause a variety of dental health issues.Coffee is a complex chemical mixture containing thousands of different chemicals such as carbohydrates, lipids, nitrogen compounds, vitamins, 35 minerals, alkaloids, and phenolic compounds. The purpose of this paper is to provide information on the impact of coffee on dental and oral health which is important because the oral cavity and teeth are the first places where drinks come into contact.The conclusion are excessive coffee consumption has been associated with various dental health issues, encompassing decreased salivary pH resulting from carbohydrate fermentation, leading to dental caries, tooth discoloration, and periodontitis, which can also contribute to tooth loss.

KEYWORDS: Coffee, dental, caries, periodontitis.

I. INTRODUCTION

Coffee consumption in Indonesia has increased in recent years. Indonesia has the highest per capita coffee consumption in Southeast Asia, with 294,000 tonnes consumed. When compared to the previous year, this data increased by 13.9% [1]. According to data from the International Coffee Organization (ICO) in 2020-2021, Indonesia ranks fifth in the world in terms of coffee consumption, with a total of 5 million bags of 60 kg size [2].

Coffee consumption can cause a variety of dental health issues. Drinking two or more cups of coffee per day may be a risk factor for periodontitis [3]. Coffee also contains tannins and chlorogenic acid, which are able to cause tooth discoloration. Furthermore, a coffee solution with a pH of 4.9-5.2 can aggravate tooth discoloration. A low pH of less than 5.5 can cause the oral cavity to become acidic, resulting in the demineralization of the enamel [4]. Caries can also be a risk factor for coffee drinkers if they add sugar, cream, or other sweeteners to their coffee [5]. The purpose of this paper is to provide information on the impact of coffee on dental and oral health which is important because the oral cavity and teeth are the first places where drinks come into contact.

II. REVIEW

Composition of Coffee

Coffee is a complex chemical mixture containing thousands of different chemicals such as carbohydrates, lipids, nitrogen compounds, vitamins, 35 minerals, alkaloids, and phenolic compounds [6]. Coffee contains the following bioactive compounds: phenolic compounds (such as chlorogenic acid), methylxanthines (caffeine, theophylline, and theobromine), diterpenes (including cafestol and kahweol), nicotinic acid (vitamin B3) and its constituents, trigonelline precursors, magnesium, and potassium [7].

Effect of Coffee On Salivary Acidity (pH)

Coffee consumption has the potential to lower salivary pH because coffee contains high carbohydrates, sucrose, and monoxide. Streptococcus mutans can lower saliva pH by fermenting carbohydrates into acid in the mouth [8]. According to Andriany et al (2012), carbohydrates are fermented by bacteria in the mouth and produce acids that can lower salivary pH. This situation is a critical pH level that can lead to tooth decay. The tendency of coffee to affect the pH after consumption makes saliva often included in the acid criteria. Salivary pH changes are important for dental health. The majority of studies on salivary pH have been conducted on the development of bacterial plaque and caries [8,9].

Effect of Coffee On Dental Caries

Coffee, in addition to potentially lowering salivary pH, can cause caries because it contains carbohydrates, sucrose, and monoxide [8]. Especially when sweeteners like sugar, cream, or other sweeteners are added. This is because caries is a sugar-dependent bacterial disease, and, among other dietary components, sucrose is considered the most cariogenic because it is absorbed and metabolized by microorganisms in dental plaque [5]. Coffee's sugar content can cause bacterial fermentation, which can damage the enamel surface [10].

Furthermore, as mentioned previously, coffee can cause a decrease in pH due to the contents of the coffee. A low pH of less than 5.5 can cause the oral cavity to become acidic, resulting in enamel demineralization [4]. Caries is more likely to occur when the pH in the mouth is acidic.

Effect of Coffee On Tooth Discoloration

Coffee has been identified as one of the primary discoloration agents. Coffee, when consumed frequently, is associated with extrinsic staining found on the outer surface of the teeth. This is due to the pH value and components in coffee, specifically flavonoids, and phenols which influence the level of discoloration [5]. Coffee also contains tannins and chlorogenic acid which can cause tooth discoloration. External tooth discoloration is typically caused by the deposition of chromogenic agents onto the tooth enamel surface. Furthermore, a coffee solution with a pH of 4.9–5.2 can also aggravate tooth discoloration [4].

Restorative materials are susceptible to staining because coffee and other coloring foods and drinks can cause stains on teeth. Coffee extract is associated with color changes in all types of resinous materials because it contains ionized groups or highly reactive metabolites, such as flavonoids and phenols, that are water-soluble. This effect is directly related to coffee concentration. Absorption of these water-soluble components on the surface can cause additional discoloration. The presence of sugar in coffee increases the discoloration of the restorative material, this is due to the sticky effect of sugar on coffee coloring [5].

Effect of Coffee On Periodontitis and Tooth Loss

According to Han et al. (2016), coffee is associated with an increased risk of periodontal disease in adult men in Korea. This is because caffeine has been linked to a variety of effects on bone metabolism, and excessive caffeine consumption is one of the risk factors for periodontitis progression. Caffeine has been shown to promote bone loss and inhibit bone healing following tooth extraction [3]. Coffee consumption can result in tooth loss due to periodontitis, which is one of the leading causes of tooth loss. Caffeine consumption can also damage calcium metabolism, lead to decreased bone mineral density, and delay bone repair. Caffeine may also inhibit osteoblast development by decreasing the expression of vitamin D receptors on the surface of osteoblasts or by causing the upstream mediator cyclic AMP to inhibit osteoblast proliferation. Coffee consumption was linked to an increased risk of osteoporosis and osteoporotic fractures. Since caffeine can lead to osteoporosis, tooth loss also increases as the risk of osteoporosis increases [10].

III. DISCUSSION

Excessive coffee consumption hasnumerous negative consequences for dental and oral health. Coffee consumption has been associated with lower salivary pH, which can lead to dental caries. This is attributed to coffee's components, including carbohydrates, sucrose, and monoxide. The acidity of saliva plays a crucial role in the occurrence of dental cavities or caries levels; higher salivary flow facilitates caries formation. The pH level is a critical factor in preventing dental caries and tooth demineralization. While the normal pH of saliva ranges from 6.7 to 7.4, breakdown of carbohydrates by bacteria produces lactic acid, butyric acid, and aspartic acid, lowering saliva pH. When pH drops below 5.5 (the critical pH value), acids start eroding tooth enamel. Prolonged exposure to low salivary pH increases the likelihood of dental caries development [11,12]. A pH below 5.5 has been reported to acidify the oral cavity, leading to enamel demineralization [4].

Coffee contains tannins and chlorogenic acids, both implicated in tooth discoloration, along with flavonoids and phenols, which affect discoloration levels. Tooth discoloration typically results from chromogenic agent deposition on tooth enamel surfaces. Coffee drinks contain red, yellow, and brown pigments, contributing to tooth discoloration. Tannin, a compound reacting strongly with all proteins, including tooth proteins, could also cause discoloration. Pratomo et al. (2018) noted that the 2.56% tannin content in coffee beans before roasting likely contributed to color changes. Combined with a coffee solution pH of 4.9-5.2, it may exacerbate tooth discoloration. The low pH of coffee drinks demineralizes tooth enamel and deposits chromogenic agents, explaining the high discoloration values observed in the study [3,4].

Caffeine may also adversely affect dental health, according to several studies. Han et al. (2016) reported that coffee, containing caffeine, may have multiple effects on bone metabolism when consumed excessively and may be a possible risk factor in periodontitis progression. Another study by Song et al. (2018) found significantly increased coffee consumption among individuals with periodontitis in Korean adult males, with a 45% higher prevalence of periodontitis when drinking coffee three or more times per day. Caffeine consumption can disrupt calcium

metabolism, reduce bone mineral density, and delay bone repair. Caffeine may inhibit osteoblast development by reducing vitamin D receptor expression on osteoblast surfaces or by inducing cyclic AMP, which inhibits osteoblast proliferation. Periodontal breakdown due to coffee consumption may result in tooth loss, a leading cause of tooth loss. Coffee consumption was significantly associated with increased osteoporosis and osteoporotic fracture risk. As caffeine-induced osteoporosis escalates, so does tooth loss risk [10].

Coffee drinkers may add sugar or syrup, further damaging tooth structure. Women consuming 1-4 or more cups of sweetened coffee daily faced higher tooth loss risk. Coffee sugars like sucrose can ferment bacteria, leading to enamel surface destruction. Studies showed that coffee consumption with additives like sweeteners and creaming agents increased caries risk, whereas black coffee consumption had a caries-preventive effect. The caries index was 2.9 in black coffee drinkers and 5.5 in those adding additives [10]. Caries, a sugar-dependent bacterial disease, considers sucrose the most cariogenic dietary component as it's absorbed and metabolized by dental plaque microorganisms. Frequent sucrose exposure (three to six times daily) suffices for tooth tissue demineralization [5].

IV. CONCLUSION

Excessive coffee consumption has been associated with various dental health issues, encompassing decreased salivary pH resulting from carbohydrate fermentation, leading to dental caries, tooth discoloration, and periodontitis due to excessive caffeine consumption, which can also contribute to tooth loss. The likelihood of encountering numerous dental health problems increases, particularly if additives such as sugar, milk, and cream are incorporated into the beverage. This is attributable to the presence of sucrose in sugar and other coffee constituents like chlorogenic acids, tannins, and caffeine. Therefore, individuals are advised to consume coffee in moderation, as excessive coffee intake can have detrimental effects on dental and oral health, as outlined in this article.

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