Antibacterial Effect and Factors Influencing the Relationship between Coffee, Tea Consumption and Dental Caries

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Authors’ contributions

All authors contributed to data analysis, drafting and revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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ABSTRACT

Aims: To assess the association between the frequency and quantity of coffee and tea consumption and dental caries severity among adolescents (middle and high schools) in the Eastern Province, Saudi Arabia.

Study Design: This is an observational cross-sectional study.

Place and Duration of Study: Conducted in the Eastern Province (Dammam and Al-Khobar), Saudi Arabia, from January to February 2019.

Methodology: A cross-sectional observational survey study that was carried out in Eastern Province, Saudi Arabia. Validated interview-based questionnaires were used to ask about the background information and the frequency and quantity of coffee and tea consumption with two sections of the survey: The first section was about the demographic data and the second section assessed the frequency and quantity of coffee and tea consumption and examination was done during daylight using disposable dental mirror and blunt probe.

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A total of 2265 middle school children with a response rate of 77.8%. Out of them, Females accounted for 1288 (56%) and the mean age (±SD) was 14 (±1.322). Regarding parents’ education, 1916 (84.6%) of participants’ fathers and 1836 (81.1%) of their mothers had a high school certificate or higher. There was a significant association between the frequency of coffee and tea consumption and caries (p=0.013).

**Conclusion:** There was a significant association between the frequency of coffee and tea consumption and caries (p=0.013). The frequency of coffee and tea consumption, the higher the caries. However, there was no association between the quantity of coffee and tea consumption and D nor with the overall DMF score.

**Keywords:** Tea consumption; coffee consumption; dental caries.

**ABBREVIATIONS**

**DMF:** Decayed, Missing and Filled index

**1. INTRODUCTION**

Caries is a multifactorial disease of the teeth that leads calcified tissue to dissolve and be destroyed locally [1]. The three prerequisites for the formation of a carious lesion are teeth, plaque, and substrate (diet). Caries susceptibility varies by tooth shape, morphology and location, all of which can enhance plaque retention [2]. Children's pain from untreated caries can impact their attendance at school, their ability to eat and talk, and, as a result, their growth and development. [1]. Although researchers and dentists are working to improve the prevention and treatment of dental caries, a realistic answer to this “silent pandemic” is a preventative strategy in a public health scenario [3].

Commercially available in the market are three varieties of tea (green, black, and oolong tea) and 2 types of coffee (ground and instant coffee). Coffee and tea are recognized to have a variety of biological characteristics, like as Their involvement in the development of chronic illnesses such as cancer and cardiovascular disease is protective [4]. The two hemolytic streptococci, streptococcus mutans and s. Sobrinus, are considered to be the primary etiological factors, but numerous other kinds of bacteria (particularly lactobacilli and actinomycyes) may also be implicated [5]. Green tea, cocoa, and coffee extracts reduced glucosyltransferase activity and glycan formation, while aqueous extracts of several African plants have also been demonstrated to blocks attachment. Mutants to hydroxyapatite or glass beads [6]. Summer extracts of oolong tea leaves had the highest activity, followed by extracts made in the spring, winter. The findings show that the antibacterial activity of teas is connected to flavonoid levels, which are regulated by fermentation degree and harvesting season. [7].

Further research is needed to determine the function of caffeine and other natural coffee components in coffee's antibacterial action [8]. In addition, tea contains trace levels of fluoride and aluminum. Among them, polyphenols are the most intriguing and compose the majority of the bioactive molecules in tea; as a result, tea is regarded as a significant dietary source of polyphenols, particularly flavonoids. Tea components have also been found to enhance the acid resistance of dental enamel [9]. Coffee and tea are the second most consumed drinks after water [10]. Numerous studies have been conducted in KSA to find out the prevalence of the caries among adolescents. A systemic review studied the national prevalence of dental caries and its severity in children in Saudi Arabia and concluded that 70% of children's permanent teeth were carious with mean DMF score of 3.5 [11]. The effect of consuming coffee and tea on dental caries is controversy. A study done in Bangalore reported that coffee and tea consumed alone had anti-carious action, but in the presence of additives the antibacterial and anti-carious action was totally minimized [12]. On the other hand, a study in Thailand found that coffee and tea consumption is related to caries among middle school children [13].

The relationship between coffee and tea consumption and dental caries in Saudi Arabia has not been covered adequately. This study hypothesized that there is a relationship between the frequency and quantity of coffee and tea consumption and dental caries severity among middle school children in Eastern Province, Saudi Arabia. Investigating such an association can be used to increase the awareness of the society regarding the effects of different beverages in the dental health. The aim of the study was to assess the association between the frequency and quantity of coffee and tea consumption and dental caries severity among adolescents in the Eastern Province, Saudi Arabia.
2. MATERIALS AND METHODS

2.1 Study Design

This cross-sectional, survey-based study was conducted among middle and high schools in Eastern Province (Dammam and Al-Khobar), Saudi Arabia from January to February 2019. The inclusion criteria were all middle school grades (7th, 8th, and 9th) grade of both genders, nationalities in the Eastern Province, Saudi Arabia (Dammam and Al-Khobar). The exclusion criteria were older than 15 years and had medical problems and/or special health care needs. The schools were randomly selected and stratified by gender then the students sampled using cluster sampling.

2.2 Data Collection

Data was collected using a validated interview-based questionnaires and examination was done during daylight using disposable dental mirror and blunt [probe. A Validated interview-based questionnaire was used to ask about background information and the frequency and quantity of coffee and tea consumption (exposure) [14,15]. The survey was divided into two sections: the first section was about the demographic data and the second section assessed the frequency and quantity of coffee and tea consumption. Responses to frequency questions were categorized as never, daily and weekly or monthly. Responses about the quantity were categorized into never, ≤149 ml-299 ml, 300 ml-599 ml and 600 ml≥750 ml. Dental caries (outcome variable) was measured by DMF index using WHO criteria [14]. The examination was carried by 18 calibrated examiners (Kappa≥0.6).

2.3 Statistical Analyses and Sample Size Calculation

Data were represented in the form of frequencies (number of responders) and valid percentages for categorical variables. Mean (SD) and frequency and percentage were calculated. The association between the frequency and quantity of coffee and tea consumption and DMF was analyzed using one-way ANOVA. P-value of ≤0.005 was considered significant. All P values < 0.05 were considered statistically significant. IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) was used to perform all statistical calculations, version 23 for Microsoft Windows. Considering a confidence level of 95%, a marginal error of 5%. A total of 2265 eligible participants responded to the questionnaire and examination was done were included in the statistical analysis.

3. RESULTS AND DISCUSSION

Data was collected during the period from January to February, 2019. A total of 2265 middle school children with a response rate of 77.8%. Out of them, Females accounted for 1288 (56%) and the mean age (±SD) was 14.08 (±1.322). Regarding parents’ education, 1916 (84.6%) of participants’ fathers and 1836 (81.1%) of their mothers had a high school certificate or higher. A total of 2265 participants met the eligibility criteria and were included in the statistical analysis. The socio-demographic characteristics of the participants are shown in Table 1.

The mean (±SD) DMF of participants was 3.99±3.33 where D was 3.14±3.06. The percentage of children who had never consumed coffee and tea was 502 (22.2%) where 305 (69.9%) of females and 151 (30.1%) of males never consumed coffee and tea. From the participants, 817 (36%) of them drank coffee and tea once or more daily while the highest consumption rate (defined as consuming ≥600 ml) of coffee and tea was reported only by 23 (1%) of the participants.

Table 1. Socio-demographics characteristics of the study participants (n=2265)

<table>
<thead>
<tr>
<th>Socio-demographics characteristics</th>
<th>Mean</th>
<th>±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>14.08</td>
<td>1.322</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>977</td>
<td>43.1%</td>
</tr>
<tr>
<td>Female</td>
<td>1288</td>
<td>56.9%</td>
</tr>
<tr>
<td>Educational Level</td>
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<td></td>
</tr>
<tr>
<td>Mother Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>429</td>
<td>18.9%</td>
</tr>
<tr>
<td>high school or higher</td>
<td>1836</td>
<td>81.1%</td>
</tr>
<tr>
<td>Father Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>349</td>
<td>15.4%</td>
</tr>
<tr>
<td>high school or higher</td>
<td>1916</td>
<td>84.6%</td>
</tr>
</tbody>
</table>
There was a significant association between the frequency of coffee and tea consumption and D component \( (p=0.013) \) whereas the association was not significant with the overall DMF score \( (P=0.095) \). Fig. 1 shows the relationship between the frequency of coffee and tea consumption and caries.

In the same context, no association was found between quantity of coffee and tea consumption and D nor with the overall DMF score \( (p=0.745;0.572 \text{ respectively}) \). Fig. 2 shows the relationship between the quantity of coffee and tea consumption and caries.
3.1 Discussion

There was a significant association between the frequency of coffee and tea consumption and caries. The more the frequency of coffee and tea consumption, the higher the caries. However, recent studies, found out that coffee is beneficial for our teeth. Furthermore, coffee made up from roasted beans has anti-cariogenic activity [16]. Coffee is active against Streptococcus Mutans. Furthermore, coffee and tea consumption stimulates the inhibitory effect of caries formation by preventing salivary amylase [17,18]. This contrary can be justified by knowing the fact that the combination of caffeine with sugar may cause initial caries and rapid progression of dental caries. In rare case, salivary secretion is dramatically decreased leading to plaque formation and eventually gingivitis [19]. Furthermore, one study found that DMFS scores of those who consumed coffee varied from 2.9, where coffee was consumed without sugar and milk and 5.5 when it was taken with milk and sugar indicating that coffee has anti-caries action [12]. In addition, another study concluded that sucrose intake in coffee or tea (SCT) increases the potential of coronal and root caries in elderly [20]. Consequently, further studies are needed to assess the effect of the co-founders as brushing habits and coffee and tea additives’ which have not been studied in the present study.

4. CONCLUSION

There was a significant association between the frequency of coffee and tea consumption and D-component of DMF. The more the frequency of coffee and tea consumption, the higher the caries. However, there was no association between the quantity of coffee and tea consumption and D nor with the overall DMF score. Further studies are needed to assess the effect of the co-founders as brushing habits and coffee and tea additives’ which have not been studied in the present study.

CONSENT

All participants written consents from their parents and willing to be interviewed and examined if they agree or not to take part in the study. Only those who agreed to participate were included.

ETHICAL APPROVAL

Before conducting any study-related procedures, ethical approval was obtained from Research Ethics Committee at Imam Abdulrahman bin Faisal University, Saudi Arabia.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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