Black Tea and Green Tea in Reducing Children Dental Caries

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Abstract. Dental caries is a most prevalent oral disease in children. There were tendency of diverse children drink consumption including soft drinks that attracts by its taste and flavor and causing dental caries. Earlier study suggested that tea had important element in dental caries inhibition. Hence this study was conducted to evaluate and compare pH of saliva after rinsing with green tea and black tea. Methods for his study was conducted among thirty two healthy school children between 10-12 years old. The subjects who fulfilled inclusion and exclusion criteria were selected and randomly divided into two groups. The first group had rinsing with green tea and the other group with black tea. They were asked to rinse for one minute after sugary soft drink consumption. Then salivary pH were measured using pH meter.. Statistical analysis was done using Mann Whitney test. $p < 0.05$ was considered statistically significant. Results of this study showed that there was no statistically significant difference among subjects rinsing for one minute with green tea and black tea after sugary soft drink consumption. But green tea showed much better effect in rising salivary pH. As the conclusion that green tea showed a promising greater rising on salivary pH than black tea after sugary soft drink consumption in children.

Keyword(s) : dental caries, tea, children

1. Introduction

Dental caries is one of the most prevalent chronic oral disease among children and adult in the world [1]. In Indonesia according to Basic Health Research (Riskesdas) comparing the results in 2007 to 2013, the DMFT-index increased from 43.4% to 53.2% [2]. World Health Organization also mentioned that in several developing countries, the level of dental caries is higher in primary dentition than permanent dentition [3]. Untreated dental caries can affect in daily activities performance which exert into negative impact on oral health-related quality of life [4]. Children suffered from pain, difficulty of chewing, problem regarding self-esteem and esthetic concerns also sleeping problem [5].
Prevention of dental caries becomes great of importance [4].

In Indonesia sugary soft drinks have become increasingly available in the market. The consumer were not limited to adults but also children. This has resulted in a major concern their health implications. There was a dynamic relationship exists between the sugars in these drinks and teeth. They affect the integrity of the teeth by altering the pH of the saliva as well

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as dental plaque. These sugars are metabolized to acids by plaque bacteria, which in turn lowers plaque and salivary pH, causing tooth demineralization. Several studies have shown direct relationship between dental caries and soft drinks.[6,7]

One nature product to increase caries prevention was tea. Many research focused on tea as herb that may reduce dental caries. Tea is one of the oldest beverages in the world. History revealed that consumption of tea began around 2000 BC in China . There were some type of tea including black tea, green tea, oolong tea, white tea, red tea and puerh tea. In Indonesia, people were familiar with black tea and green tea. Although many study revealed the relationship between tea and dental caries, but still lack of comparison of green tea and black tea in vivo with emphasizing in reducing dental caries especially after taking sugary soft drink.

2. Material and Methods

Approval from the Research Ethics Committee of the Faculty of Dentistry of the Moestopo University was obtained prior to the study. A purposive sample of children were recruited from one school in Pesanggrahan district of South Jakarta after sought permission from the principal of the school. Informed oral and written consent was obtained from the parents of the children.

Thirty two healthy children in that school, aged between 10 to 12 years were participating in this study. The subjects who fulfilled inclusion and exclusion criteria were selected and randomly divided into two groups with 16 children in each group. The first group had rinsing with green tea and the other group with black tea after sugary soft drink consumption. Inclusive criteria for this study were: 1) healthy children aged between 10-12 years without any known systemic condition, 2) children had written consent from their parents, 3) children were used to taste of soft drink and tea. Exclusive criteria were: 1) Children with a known medical history especially diabetes or allergy, 2) children suffered pain from any carious lesion.

2.1. Preparation of Solution

Green tea solution was extracted from fresh green tea (OSK Japanese green tea bags, packing date less than 1 month). Five percent green tea was prepared with 2 g of green tea bag dipped in 100 ml hot water for 5 minutes (10 ml for each participant). Black tea solution was extracted from fresh black tea (Tong Tji black tea bags, packing date less than 1 month). Two percent black tea was prepared with 2 g of black tea bag dipped in 250 ml hot water for 3 minutes (10 ml for each participant). All aqueous extract of green tea and black tea were left to cool at room temperature.

2.2. Salivary pH measurement

All the students were asked to drink 100 ml of soft drink for baseline and after 30 minutes, they were asked to spit. The whole saliva samples were collected by pooling saliva with the head tilt down bit and then spitting in a disposable container. After the first collected saliva for baseline, the designated rinse with tea was dispensed to the respective group. They were instructed to swish the 10 ml of mouthrinse for 1 min. The same method of saliva collection was repeated for second collected saliva into another disposable container. Salivary pH was measured using pH meter (pH 2011 ATC).

2.3. Statistical analysis

The mean pH at baseline and after tea rinsed was compared with Wilcoxon test. The mean change of pH from baseline were compared for the difference between two groups using Mann Whitney test. The level of significance was set at 5%. All $p < 0.05$ was considered statistically significant.

3. Results

The mean pH of green tea [Table 1] and black tea [Table 2] before and after taking sugary soft drink were compared using Wilcoxon test, which revealed that the salivary pH were increased in the children after rinsing with green and black tea respectively. As shown in [Table 1], [Table 2] the pH baseline after sugary soft drink consumption dropped to average 5.7. But after rinsing with green tea or black tea according to the groups, the salivary pH increased to 7.11 and 6.85 respectively. The result indicated a statistically significant difference ($p < 0.05$).

On comparison the mean change of pH between baseline and after tea rinsed against both green tea group and black tea group were using Mann Whitney test. There was no statistically significant difference in green tea 0.5% group and black tea 0.2% group were observed [Table 3]. Despite of no statistical difference, rinsing with tea increased salivary pH, especially green tea showed a little bit greater increasing than the black tea.

Table 1. Comparison of salivary pH in before and after rinsing with 5% of green tea (n=16)

	n	Median (min-max)	p
Baseline (after 30 min sugary soft drink)	16	5.75 (5.11 – 6.50)	0.000*
After 1 min rinsing of green tea	16	7.11 (6.90 – 7.30)	

*p≤0.01,CI 95%, Wilcoxon test

Table 2. Comparison of salivary pH in before and after rinsing with 2% of black tea (n=16)

	n	Median (min-max)	P
Baseline (after 30 min sugary soft drink)	16	5.75 (5.11 – 6.50)	0.000*
After 1 min rinsing of black tea	16	6.85 (6.50 – 7.25)	

*p≤0.01,CI 95%, Wilcoxon test

Table 3. Comparison of salivary pH different between green tea and black tea (N=32)

	n	Median (min-max)	p
Mean change of green tea pH	16	1.35 (0.75 – 2.03)	0.086*
Mean change of black tea pH	16	1.13 (0.30 – 1.78)	

*p>0.05,CI 95%, Mann-Whitney test

4. Discussion

The aim of this study was to evaluate the effect of green tea and black tea as mouthrinse on salivary pH after sugary soft drink consumption in children. Salivary pH was one of the

key indicators of carious process [8]. Low salivary pH promoted the growth of acidogenic bacteria as a pathological factor for dynamic imbalance of demineralization and remineralization dental hard surface. In this study low salivary pH was still in critical pH after 30 min from sugary soft drink consumption. This low salivary pH put the children in high risk of having dental caries. In Indonesia, sugary soft drink is easy to get in many local markets that put dental caries as one of primary health problem. Controlling salivary pH give a possibility to prevent dental caries [9].

Stephan and Miller in their classic studies in the early 1940s, dental plaque exposed to sucrose leads to acid production, causing a rapid drop in pH leading to the initiation of caries [10]. The present study showed that baseline mean pH after 30 min drinking sugary soft drink was 5.75. The salivary pH was increased after rinsed with green and black tea to 7.11 and 6.85 respectively. Srinidhi et al in their study was observed that there was increasing in salivary pH after rinsing with green tea and black tea. Their results was same with this study that the pH rise was more in green tea intake compared to black tea [11]. In our study, it was observed that green tea and black tea mouthrinse showed statistically significant results in rising the alkalinity of saliva compared with the baseline ($p < 0.005$).

Studies have shown that consumption of tea reduced caries development and the effect was attributed to its fluoride content polyphenols and catechin. The catechins present in green tea contributed a significant effect on pH of saliva and dental plaque. A study conducted by Hamilton-Miller concluded that rinsing with green tea catechins for a suitable time prevented acid production and preserved pH within the normal range (7.2–7.4). This normal pH was not favorable conditions for Streptococcus mutans growth [12].

From the present study, it was observed that salivary pH was increased greater in green tea mouth rinse compared to black tea mouth rinse, but the result was not statistically significant. Garg et al in their research stated that black tea lost its anti-streptococcal property after 5% dilution but green tea having sufficient anti streptococcal property even after 2% dilution. It suggested that green tea had much more anti streptococcal effect even in low concentration [13]. Many study reported that green tea was more effective than black tea, except one study from Jalayar Naderi et al. They proved that anti-Streptococcus mutans activity of Iranian black tea is more than green tea [14].

In this study green tea and black tea will give benefit in increasing the salivary pH but also decrease acidogenicity and thus reducing the risk of demineralization. Thus, the present study intended to compare salivary pH change after consumption of green tea and black tea which has not been addressed in literature especially with emphasizing on time after taking sugary soft drink. Awadalla et al said that green tea considerably prevent drop in plaque pH on oral rinsing [15]. Indonesian people are familiar with tea especially black tea but nowadays green tea is not a new name. Green tea become popular beverage and widely consumed.

Catechins was believed to possess antiplaque and antibacterial properties. They created interaction with barrier function of microorganism and depletion of this microorganism, thus contributing to caries prevention [15]. A study proved that local application (oral rinsing) with green tea solution for short time significantly inhibits decrease in plaque pH [16]. Another in vivo study from Otake et al. [17] suggested that polyphenolic compounds in green tea attributed to high-inhibitory effect against Streptococcus mutans bacteria growth. Moreover, 5-min brewing of green tea produced the best flavor with least extraction of unpleasant tasting tannin [18]. The additional advantage was fluoride content of of tea was 0.005–371 mg/kg, which was said to increase with the brewing time [19]. Talreja suggested

to have regular oral application of green tea solution in the form of mouthwashes or its addition to dentifrices [16].

Following the research from Moynihan and Lopez-Gomez, this study included school-going children of 10–12 years as developing permanent dentition and changing dietary and fluid consumption pattern make them more susceptible to develop caries [20,21, 22, 23]. Several studies have indicated that in children and adolescents, sugar-sweetened beverage consumption has increased [22]. This alteration of beverages may be attributed to the conveniently available various vending machines at school [24] or here in Indonesia contributed by the easily got in school canteen or many small local store around the school. Furthermore, maybe like in many other schools, canteen have "tied-ups" with their beverage suppliers and they got benefit in proportion to beverage sales [24].

Besides the advantages of green tea, there were many studies reported the adverse effects of green tea for children. Mostly they gave attention to the caffeine content which may cause insomnia, inability to concentrate, irritability, or hyperactivity [25]. However, in our study, children would be considered safe as green tea was used only for short time and had its topical benefits, thus all the systemic side effects were avoided.

Limitation of this study was the lesser sample size and short time of clinical study Further, long-term clinical studies are required to evaluate the efficacy of green tea and black tea mouthrinse on salivary pH along with microbiological evaluation.

5. Conclusions

This study showed that either green tea or black tea had property to increase caries prevention by rising salivary pH. But green tea showed a promising greater rising on salivary pH than black tea after sugary soft drink consumption in children. Further studies factors especially on green tea which may be effective in dental caries and in vivo study is strongly recommended.

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