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The differences of consuming star fruit and guava on index debris and Plak index in students

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Abstract
Introduction: Poor dental and oral hygiene can cause dental and oral problems. Actions that can be taken to maintain dental and oral hygiene are by brushing your teeth and consuming fibrous and watery fruits such as water guava and sweet starfruit, because these fruits containing fiber and water have the ability as a natural cleanser (self-cleansing) on the teeth which can clean the tooth surface by stimulating the flow of saliva. The aim of the study was to determine the effectiveness of consuming water guava and sweet starfruit for self-cleansing at SDN I Gandul, Depok.
Methods: The type of research used is descriptive quantitative with quasi-experimental methods. The research design uses 2 sample groups by measuring pre-test and post-test. The sample used was students of class V-VI at SDN I Gandul, Depok. Data analysis was performed using univariate and bivariate analysis Paired t-test.
Results: The results showed that the average Debris Index before consuming water guava fruit was 1.86 and after consuming water guava fruit was 0.91 and the results of the paired t-test obtained a p-value = 0.000 (<0.05) also the average debris index before consuming star fruit sweet 1.76 and after consuming sweet star fruit 0.97 and the results of the paired t-test obtained p-value = 0.000 (<0.05). It was found that the average plaque index before consuming water guava fruit was 2.1 and after consuming water guava fruit was 1.1 and the results of the paired t-test obtained a p-value = 0.000 (<0.05) also the average plaque index before consuming sweet starfruit was 1. 8 and the average after consuming sweet starfruit was 0.82 and the results of the paired t-test obtained a p-value = 0.000 (<0.05).
Conclusion: It can be concluded that consuming guava and starfruit are effective for the self-cleansing mechanism because there is a decrease in the average debris index and plaque index.

Keywords: Carambola fruit, guava fruit, self-cleansing, index debris, index plaque

1. Introduction
Oral hygiene can be assessed through the presence of food remnants, dental plaques, dental calculi, and other organic deposits. Dental and oral hygiene are not solely determined by the evaluation of debris and plaque [1]. The accumulation of debris and plaque is influenced by the types of foods individuals consume, which can vary from fibrous and watery to sweet, soft, and sticky [2]. Physiologically, debris and plaque can be naturally cleaned through saliva flow and mouth movements during the process of eating [1].
According to the World Health Organization (WHO) in 2018, 60-90% of school-age children experience tooth and mouth problems, often leading to pain and discomfort [3]. In the 2018 Basic Health Research (RISKESDAS), Indonesia reported a 57.6% prevalence of oral and dental problems, with Central Java estimating it at 56.7%. These oral issues are commonly associated with poor oral and dental hygiene. The high incidence of oral problems is influenced by various factors, including a lack of awareness regarding the importance of oral and dental health. In 2018, only 1.3% of the Indonesian population aged 10-14 exhibited correct teeth-brushing behavior, while 97.93% brushed their teeth daily [4].
The lack of awareness regarding dental and oral health among individuals leads to dental caries (tooth decay) [5]. Debris and leftovers around teeth, along with plaque harboring bacteria on tooth surfaces, contribute to tooth decay [6]. Debris consists of soft materials found on tooth surfaces, composed of biofilm layers and food remnants [7]. Dental plaque is a thin, transparent layer that forms on tooth surfaces when exposed to saliva [8].

Plaque can contribute to oral and dental disorders such as cavities, periodontal diseases like gingivitis (gum inflammation), and other oral issues [9]. Reducing debris and plaque can be achieved by consuming fibrous and watery fruits like guava and pickles [10].

A study conducted by Nopiransi & Deynilisa (2019) in 2019 demonstrated a reduction in debris index before consuming 1,557 guava fruits, with an average index debris of 2.17 (categorized as "ugly"). After consuming 1,443 guava fruits, the average index debris dropped to 1.09 (classified as "moderate"). Similarly, the index plaque decreased from 1,667 before consuming guava fruit to an average of 1.478 afterward. The average index plaque before chewing the fruit was 2.21 ("ugly"), which improved to 1.07 ("moderate") after consuming the fruit.

Guava contains 87 grams of water and 0.9 grams of fiber per 100 grams of fruit [12], while starfruit (belimbing) contains 90 grams of water and 0.9 grams of fiber per 100 grams of fruit [13]. Fibrous foods like fruits and vegetables can serve as a natural self-cleaning mechanism for tooth surfaces because they indirectly brush the teeth when chewed [14]. These foods typically contain 75-95% cleansing water and stimulate saliva secretion when chewed [15]. In this study, researchers used guava fruits and pickles, both of which had been cooked [16].

Children in grades V-VI, aged 10 to 12, are at the stage of transitioning from milk teeth to permanent teeth. At this age, they are vulnerable to tooth and mouth diseases, especially dental caries, which is often a result of poor dental hygiene. Preliminary studies conducted at SDN Sambiroto 3 Sendang Mulyo Tembalang Semarang involved live observations of 15 randomly selected V-VI classes. The results indicated that the average Oral Hygiene Index-Simplified (OHIS) was 2.5, significantly higher than the national target of 1.2. This high OHIS score is attributed to elevated debris index (DI) and plaque index (PI).

Considering the aforementioned context, the researchers were motivated to conduct a study titled "The Difference in the Impact of Consuming Guava and Starfruit on Self-Cleansing Mechanisms and the Index of Debris (DI) and Plaque (PI) at SDN Sambiroto 3 Sendang Mulyo Tembalang Semarang.

Method

This study employed a quasi-experimental research design, incorporating pretest and posttest assessments. It utilized two groups for sampling, both subjected to treatment, which involved initial and concluding observations to gauge the index debris condition before and after the intervention (comprising guava fruit consumption and rubbing). The sample size comprised 43 pupils, selected at random. Data collection was facilitated through the utilization of activity checklists and check sheets. The presentation of data includes categorical variables represented as numbers and percentages, while continuous data are presented as either mean ± standard deviation (SD) or median with Interquartile Range (IQR). Data analysis was carried out employing a paired t-test.

Result

The study involved 43 respondents, divided into two groups: Group I consisted of 22 students who consumed watercress, and Group II comprised 21 students who consumed averrhode fruit. On the first day, Group I participants were provided with an explanation of the self-cleansing mechanism. Subsequently, they were instructed to consume sweet avocado biscuits to facilitate the accumulation of debris. Afterward, the debris index was checked, and then the researcher guided the participants in chewing guava, emphasizing 32 chews. The researcher observed and recorded the process using a checklist. Following guava consumption, a debris index examination was conducted. On the second day, Group II was treated similarly to Group I, but they consumed Belimbing fruit instead. Based on the results of this research examination, the following outcomes were obtained:

Table 1: The frequency distribution mechanism of the self-cleansing debris index for guava fruit

Self-cleansing chewing mechanism	Chew using 2 sides		Chewing with 32 times	
	N	%	N	%
Executed	19	86	22	100
Unimplemented	3	14	0	0
Total	22	100	22	100

Table 1 illustrates that 86% of the participants chewed guava fruit using both sides of their mouths, while 17% did not follow this practice. Additionally, 100% of the participants chewed guava 32 times, while none refrained from doing so. This adherence to the recommended chewing method can be attributed to the fact that, prior to chewing the guava, the pupils received instruction on the self-cleansing mechanism and were guided on how to chew using both sides and maintain a frequency of 32 chews.

Table 2: Frequency distribution mechanism of self-cleansing debris Belimbing fruit index

Self-cleansing chewing mechanism	Chew using 2 sides		Chewing with 32 times	
	N	%	N	%
Executed	19	90	21	100
Unimplemented	2	10	0	0
Total	21	100	21	100

Table 2 indicates that 90% of the participants chewed the fruit using both sides of their mouths, while 10% did not. Furthermore, all participants adhered to the recommended practice of chewing guava 32 times, with no exceptions. This compliance can be attributed to the fact that, before chewing the fruit, the pupils were provided with an understanding of the self-cleansing mechanism and were guided on how to chew using both sides and maintain a frequency of 32 chews.

Table 3: Frequency distribution of the Guava fruit index self-cleansing mechanism

Self-cleansing chewing mechanism	Chew using 2 sides		Chewing with 32 times	
	N	%	N	%
Executed	20	91	22	100
Unimplemented	2	9	0	0
Total	22	100	22	100

Table 3 demonstrates that 91% of the participants chewed guava fruit using both sides of their mouths, while 9% did not. Additionally, all participants adhered to the recommended practice of chewing guava 32 times, achieving a 100% compliance rate. This adherence is attributed to the fact that, before chewing the guava, the pupils received instruction on the self-cleansing mechanism and were guided on how to chew using both sides while maintaining a frequency of 32 chews.

Table 4: Frequency distribution of the Belimbing fruit index self-cleansing mechanism

Self-cleansing chewing mechanism	Chew using 2 sides		Chewing with 32 times	
	N	%	N	%
Executed	20	95	21	100
Unimplemented	1	5	0	0
Total	21	100	21	100

Table 4 illustrates that 95% of the participants chewed mixed fruits using both sides of their mouths, with 5% not adhering to this practice. Conversely, all participants followed the recommended practice of chewing guava 32 times, achieving a 100% compliance rate. This adherence can be attributed to the fact that, before chewing the fruit, the pupils were provided with an understanding of the self-cleansing mechanism and were guided on how to chew using both sides while maintaining a frequency of 32 chews.

Table 5: Results of Index Debris and Index Plaque Analysis before and after consuming guava fruit and Belimbing

	Mean				
	N	Pre ± SD	Post ± SD	Pre and Post ± SD	p-value
Index debris-Consuming guava fruit	22	1.86± 1.25	0.91±0.32	0.95±0.29	0.000
Index debris-Consuming Belimbing	21	1.76±1.29	0.97±0.40	0.79±0.33	0.000
Index plaque-Consuming guava fruit	22	2.10± 0.94	1.10±0.34	1.00±0.25	0.000
Index plaque-Consuming Belimbing	21	1.80±0.97	0.82±0.40	0.98±0.44	0.000

Table 5 presents the debris index after consuming guava fruit and another type of fruit. Before consuming guava, the mean value was 1.86 with a standard deviation of 1.25. After consuming guava, the mean value decreased to 0.91 with a standard deviation of 0.32. The mean value before and after consuming the other type of fruit was 0.95 with a standard deviation of 0.29. A p-value of 0.000 (<0.05) was obtained, indicating statistical significance. Consequently, H0 (the null hypothesis) was rejected, signifying a significant difference between the debris index before and after consuming guava fruit.

Before consuming Belimbing fruit, the mean value of the debris index was 1.76 with a standard deviation of 1.29. After consuming Belimbing fruit, the mean value decreased to 0.97 with a standard deviation of 0.40. The mean value before and after consuming Belimbing fruit was 0.79 with a standard deviation of 0.33. A p-value of 0.000 (< 0.05) was obtained, leading to the acceptance of HI (the alternative hypothesis) and the rejection of HO (the null hypothesis), indicating a significant difference between the debris index before and after consuming Belimbing fruit.

Similarly, the mean value of the plaque index before consuming guava fruit was 2.10 with a standard deviation of 0.94. After consuming guava, the mean value decreased to 1.1 with a standard deviation of 0.34. The mean value before and after consuming guava fruit was 1.00 with a standard deviation of 0.25. A p-value of 0.000 (< 0.05) was obtained, leading to the acceptance of HI and the rejection of H0, indicating a significant difference between the plaque index before and after consuming guava fruit.

Before consuming Belimbing fruit, the mean value of the plaque index was 1.80 with a standard deviation of 0.97. After consuming Belimbing fruit, the mean value decreased to 0.82 with a standard deviation of 0.40. The mean value before and after consuming Belimbing fruit was 0.98 with a standard deviation of 0.44. A p-value of 0.000 (< 0.05) was obtained, resulting in the acceptance of HI and the rejection of H0, indicating a significant difference between the plaque index before and after consuming Belimbing fruit.

Discussion

The self-cleansing mechanism refers to the natural process of clearing leftovers from within the mouth [17]. The most effective methods for maintaining dental and oral hygiene include regular tooth brushing and the consumption of fruits high in fiber, water, and those with a hard texture. Hard-textured fruits require prolonged chewing, which aids in preventing their immediate swallowing [18]. Dewi *et al*., (2022) emphasize the importance of using both sides of the right and left jaws and chewing 32 times to facilitate natural tooth surface cleansing, which can result in self-cleansing.

Based on the study results regarding the impact of consuming guava fruit and its effect on the self-cleansing mechanism, as assessed through a self-cleansing monitoring checklist, the following findings were obtained:

Tables 1 and 3 reveal that the majority of pupils chew guava fruit using both sides of their mouths, with only a small number not following this practice. Additionally, all pupils adhere to the recommended practice of chewing guava 32 times. This adherence is attributed to the prior instruction provided to pupils regarding the self-cleansing mechanism, along with guidance on two-sided chewing and 32-fold

chewing, ensuring their understanding and willingness to follow the guidance.

Guava fruit is renowned for its high fiber content, abundant water content (87 grams per 100 grams of fruit), and a firm texture [20]. The mechanical properties of guava fibers can effectively mimic the action of a toothbrush, removing debris from dental surfaces [21]. The water content in guava stimulates saliva secretion, enhancing the self-cleansing effect in the oral cavity [22]. Furthermore, chewing guava with significant pressure requires more muscle effort, contributing to effective chewing [23].

Tables 2 and 4 indicate that the majority of students chew fruit using both sides of their mouths, with only a small number deviating from this practice. Additionally, all students consistently chew the fruit 32 times. This compliance is attributed to the prior instruction provided to students regarding the self-cleansing mechanism, including guidance on two-sided chewing and the importance of chewing 32 times. This guidance ensures that students understand and follow the recommended practice.

Belimbing fruit is another fruit rich in fiber and water, containing 0.9 grams of fiber and 90 grams of water per 100 grams [24]. The combination of fiber and water in fruits like Belimbing may stimulate saliva production, leading to a natural cleansing effect on teeth (self-cleansing) [25]. The process of self-cleansing occurs naturally due to the muscular work involved in breaking down food, which in turn triggers saliva production [26]. This muscular activity is a result of the mastication process [27].

Chewing hard foods, such as watercress and fiber-rich Belimbing [28], which have high water content and a firm texture, necessitates extended chewing and contributes to self-cleansing on the tooth surfaces [29]. The mechanical properties of chewing can produce brush-like effects that may effectively remove debris from tooth surfaces [30]. This is evident in the analysis of debris and plaque indices before and after consuming these fruits, leading to the following results.

Table 5 displays the debris and plaque indices after consuming guava water and regular fruit. The mean value before consuming guava was 1.86 with a standard deviation of 1.25, while after consumption, the mean decreased to 0.91 with a standard deviation of 0.32. The mean before and after consumption was 0.95 with a standard deviation of 0.29. A p-value of 0.000 (< 0.05) was obtained, leading to the rejection of H0 (the null hypothesis), signifying a significant difference between the debris index before and after consuming guava water. Similarly, before consuming pickled fruit, the mean value of the debris index was 1.76 with a standard deviation of 1.29. After consumption, the mean value decreased to 0.97 with a standard deviation of 0.40. The mean before and after consuming Belimbing fruit was 0.79 with a standard deviation of 0.33. A p-value of 0.000 (< 0.05) was obtained, leading to the acceptance of HI (the alternative hypothesis) and the rejection of HO (the null hypothesis), indicating a significant difference between the debris index before and after consuming Belimbing fruit.

Furthermore, the mean value of the plaque index before consuming guava fruit was 2.10 with a standard deviation of 0.94. After consumption, the mean value decreased to 1.1 with a standard deviation of 0.34. The mean before and after consuming guava fruit was 1.00 with a standard deviation of 0.25. A p-value of 0.000 (< 0.05) was obtained, leading to the acceptance of HI and the rejection of H0, indicating a significant difference between the plaque index before and after consuming guava fruit. Similarly, before consuming pickled fruit, the mean value of the plaque index was 1.80 with a standard deviation of 0.97. After consumption, the mean value decreased to 0.82 with a standard deviation of 0.40. The mean before and after consuming Belimbing fruit was 0.98 with a standard deviation of 0.44. A p-value of 0.000 (< 0.05) was obtained, leading to the acceptance of HI and the rejection of HO, indicating a significant difference between the plaque index before and after consuming Belimbing fruit. These results demonstrate the effectiveness of understanding and guidance on the self-cleansing process.

Conclusion

Based on the study's results and the investigation into the difference between consuming guava fruit and Belimbing regarding the self-cleansing mechanism at SDN I Gandul Cinere Depok. There is a notable distinction in the self-cleansing mechanism when consuming guava fruit. It is evident that 86% of pupils utilize guava fruit, with 100% of them chewing on both sides of their mouths. This difference reflects changes in the debris index and plaque index before and after consuming guava fruit, as indicated by the p-value test of 0.000 (< 0.05). This result implies a significant difference between the debris index and plaque index before and after consuming guava fruit.

Similarly, there is a discernible difference in the self-cleansing mechanism when consuming pickled fruit compared to consuming regular fruit and drinking gum. All participants in this case also chew on both sides (100%). This difference impacts alterations in the debris and plaque indices before and after consuming the fruit, as revealed by the paired test result of 0.000 (< 0.05). This finding suggests a significant difference between the debris index and plaque index before and after consuming the fruit.

Conflict of Interest

Not available

Financial Support

Not available

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