The Efficacy of the Consumption of Manalagi Apples and Fuji Apples on Decreasing Plaque Index in Students of Madrasah Aliyah Al-Hidayah Labuhan Batu Selatan, North Sumatra

Molek[1*], Dwi Setya Rini[1], Mangatas Halomoan Parluhutan Hutagulung[1]

[1] Dentistry Education Faculty of Dentistry, Universitas Prima Indonesia, Medan, Indonesia

A B S T R A C T

Caries is a common oral and dental disease. The main etiology of caries is plaque. Chewing fibrous fruits can prevent plaque accumulation, including Manalagi apples and Fuji apples. The purpose of this study was to determine the differences in the effectiveness of consuming manalagi apples with fuji apples on the reduction of the plaque index in Madrasah Aliyah Al-Hidayah students. This type of research is a quasi-experimental design with pre-test and post-test control groups. The total sample was 32 students aged 16-18. Data were analyzed by statistical test T-Test. Based on the results of the paired t-test statistical test, it was found that the average plaque index before chewing an apple was 0.63 ± 0.42 after 0.26 ± 0.26 with a mean of 0.37 ± 0.16. Meanwhile, the plaque index before chewing on Fuji apples was 1.01 ± 0.59 after 0.87 ± 0.54 with a mean of 0.14 ± 0.05. The results of the independent statistical t-test showed that the value of $p = 0.001$, which means that there is a difference in chewing Manalagi apples with Fuji apples to decrease the plaque index. The conclusion of this study is that consuming manalagi apples is more effective than fuji apples in reducing the plaque index

1. Introduction

According to WHO, dental problems that are commonly found in the teeth and oral cavity in the community are dental caries and periodontal disease. Globally, dental caries is found in 60-90% of primary school students, nearly 100% of adults have dental caries, and 15-20% of middle-aged adults (35-44 years) suffer from a severe periodontal disease which can lead to tooth loss.[1] In Indonesia, oral health is a matter of concern. Based on the Basic Health Research (Riskesdas) in 2018, as many as 93% of children under the age of 12 suffer from dental caries. In addition, there are 43.4% of Indonesian people aged 12 years and over have active caries (untreated caries) and there are 67.2% have experience with dental caries.[2]

Plaque is the main etiological factor for nyakaries and periodontal disease.[3] Plaque is a soft, colorless deposit formed from food waste containing carbohydrates such as milk, soft drinks, raisins, cakes, or candy attached to teeth which react with saliva, bacteria, and enzymes. and acid.[4] One of the indicators used to measure the level of oral hygiene of a person or community is the plaque index assessment, for the plaque index assessment is given to all teeth on the lingual and facial surfaces after giving a disclosing angle. The advantages of using this index include involving all teeth, higher accuracy, and more accurate results.[5]

Apples are one of the fruits that are useful for

controlling plaque because they contain high fiber. Naturally, apples are called natural toothbrushes. Apples prevent the formation of dental plaque through two mechanisms, the first is self-cleansing of its fiber which cleans the remaining dental plaque when biting an apple and stimulates salivary secretion, and can neutralize acidic substances because the salivary buffer system has a role in regulating the degree of plaque acidity.[6]

According to Penda et al (2015), chewing apples 32 times on the right and left sides of the jaw has been shown to control and reduce the dental plaque index.[7] Hidayati and Suyatmi's (2016) research also states that chewing apples is proven to be effective in reducing the debris index.[8] Another study conducted by Nurasiki and Amiruddin (2017) showed that chewing apples has a better effect than chewing jicama and can reduce the plaque index in elementary school students.[9]

The reason for the research choosing Manalagi apples and Fuji apples as research materials is because these fruits are easy to obtain and many people like the taste of these fruits. The choice of students at Madrasah Aliyah Al-Hidayah is because in their teenage years they already have permanent teeth except for M3 so the growth of plaque starts to go out of control. Based on the above thinking, the researcher wanted to know, the difference in the effectiveness of consuming manalagi apples to fuji apples on the decrease in the plaque index in Madrasah Aliyah Al-Hidayah students. Where is Madrasah Aliyah Al-Hidayah, located in Teluk Panji IV, Kampung Rakyat sub-district, South Labuhan Batu Regency, North Sumatra Province.

2. Methods

This research is a quasi-experimental study with a pre-test and post-test control group design. This research has received approval from the Ethics Commission with Letter Number: 021 / KEPK / UNPRI / I / 2021. This research was conducted at Madrasah Aliyah Al-Hidayah Teluk Panji IV, Kampung Rakyat District, Labuhan Batu Selatan Regency, North Sumatra Province for 2 working days. The population of this study was 140 students of Madrasah Aliyah Al-Hidayah aged 16-18 years. The research sample was taken by using the purposive sampling technique, namely the technique of determining the sample based on inclusion and exclusion criteria. To take the sample size, Federer's formula is used, namely: (n-1) (r-1) ≥ 15. The minimum sample size for each group is 16 people, divided into two, namely 16 people consuming Manalagi apples and 16 people consuming Fuji apples, so the total sample is 32 people.

In this study, the tools and materials used were: Lighting, Sonde, Mouth glass, Masks, Cotton Handscoon, Scales, Tissue, Drinking glasses, Manalagi apples, Fuji apples, Disclosing solution, Water. Sampling during the day. The researcher examined the students' teeth starting from the right maxillary teeth moving anteriorly, then moving to the left maxillary teeth, moving to the left mandibular teeth, and finally moving to the right mandibular teeth. The children who were the research samples were collected in a room. The test begins by dividing the 2 treatment groups, namely the Manalagi apple group of 16 people and the Fuji apple group of 16 people. Each group was examined for the plaque index (pretest) by dropping the disclosing solution. Observations were recorded according to the plaque index criteria with the assistance of an operator's assistant. After the pretest treatment, the patient was instructed to chew the manalagi apple and 20 gram Fuji apple weighing 32 times on both sides of the jaw. After ± 60 minutes, the respondents again put the disclosing solution on the surface of the tip of the tongue and spread it all over the tooth surface. Then, the child gargles. The remaining dye and plaque on the surface of the teeth are seen with the glass of the mouth. The results of the observations were recorded (post-test).

3. Results and discussion

The results of the study on the characteristics of the sample based on age showed that the majority of the sample was 17 years old, namely 16 people (50%),

followed by 11 people aged 16 years (34.4%), and only 5 people aged 18 years. (15.6%). In terms of gender, the results showed that the majority of the sample were women, namely 22 people (68.7%), while the male sample was only 10 people (31.3%).

The results of the study on the average plaque index before and after consuming Manalagi apples in Madrasah Aliyah Al-Hidayah students showed that before consuming Manalagi apples, the average plaque index was 0.63 ± 0.42 and after it decreased by an average the average plaque index was 0.26 ± 0.26.

The results of the study on the average plaque index before and after consuming fuji fruit in Madrasah Aliyah Al-Hidayah students showed that before consuming Fuji apples, the average plaque index was 1.01 ± 0.59 and after it decreased,

The average plaque index before consuming Manalagi apples was 0.63 ± 0.42 and after 0.26 ± 0.26.

The results of the dependent t-test statistical test showed that the value of p = 0.001 means that there is a significant difference in the average reduction in the plaque index before and after consuming apples Manalagi students at Madrasah Aliyah Al-Hidayah.

The average plaque index before consuming Fuji apples was 1.01 ± 0.59 and after 0.87 ± 0.54. The results of the dependent t-test statistical test showed that the value of p = 0.001 means that there is a significant difference in the average reduction in the plaque index before and after consuming Fuji apples on students of Madrasah Aliyah Al-Hidayah.

Based on the results of the independent t-test statistical test, it was obtained that the p-value was 0.001, which means that there was a significant difference between consuming Manalagi apples and Fuji apples on the decrease in the plaque index in Madrasah Aliyah Al-Hidayah students.

Table 1. Sample characteristics based on age and gender

Respondent characteristics	N	%
Age (years old)		
16	11	34.4
17	16	50.0
18	5	15.6
Gender		
Male	10	31.3
Female	22	68.7
Total	32	100.0

Table 2. The difference in average plaque index before and after eating Manalagi apples and Fuji apples

Treatment group	$\bar{x} \pm SD$	p
Manalagi apples		
Before	0.63 ± 0.42	0.001
After	0.26 ± 0.26	
Fuji apples		
Before	1.01 ± 0.59	0.001
After	0.87 ± 0.54	

The results of this study showed that the difference in the average plaque index before and after consuming Manalagi apples was 0.37 ± 0.16, while Fuji apples were 0.14 ± 0.05. The results of statistical tests showed that there was a significant difference between consuming Manalagi apples and Fuji apples in reducing the plaque index. In Madrasah Aliyah Al-Hidayah students p = 0.001 (p <0.05).

The results of this study are in line with Roza (2020) that students of SD Muhammadiyah 11 Mangkuyu and Surakarta have a lower plaque index before and after consuming manalagi apples.[10] Research conducted by Jannata et al (2014) can also improve the ability of manalagi apples to lower the index. plaque. This study showed that the extract of manalagi apple skins has antibacterial activity against Streptococcus mutans, one of the most common bacteria found in dental plaque.[11]

Supported by the results of Utari's research (2020) that there is a decrease in the average plaque index (before and after) consuming manalagi apples (Malus sylvestris Mill).[12] In a study conducted by Cempaka et al (2014), shows that the average content is the average level of quercetin in fresh apples and manalagi apple juice is quite high.[13]

The research of Handayani et al. (2018) showed the same results as this study, namely a significant decrease in the plaque index after eating Fuji apples, and the average plaque index value before and after treatment was 48.81 ± 17.51 and after being given treatment 29.44 ± 14.95. The reason is, according to laboratory tests, Fuji Apple contains flavonoids (catechin equivalent / 100 g). Among several varieties of apples that are common in the United States, they contain 100-120 mg, such as gala, red delicious, golden delicious, liberty, northern spy, Rome beauty, fortune, Idared, Cortland, Jonagold, empire. research by Huda et al (2015) shows that there are significant differences before and after consuming 100 grams of Fuji apples.

In this study, it appears that consuming Manalagi apples and Fuji apples can lower the plaque index.

According to Roza (2020), after consuming manalagi apples and fuji apples, a decrease in the plaque index can be caused by the chewing process of fibrous food which causes mechanical, chemical, and physiological effects that can reduce food retention in the oral cavity and can improve food cleaning. Manalagi apples and Fuji apples have a fibrous and dense texture. In the process of chewing solid and fibrous food, it can stimulate more saliva secretion. Food remains trapped between pits and fissures, such as saliva dissolved sugar components, and can rinse teeth from adhering particles.[15] When eating, fine fiber particles stuck between the teeth can be used as a natural- floss, the increase in salivary secretion rate is proportional to the increase in salivary pH, which is due to the presence of bicarbonate as part of the buffer system in the oral cavity. The buffer system also has the effect of regulating the acidity of plaque in the oral cavity.[16]

Utari's research (2020) also shows the benefits of apple manalagi in reducing the plaque index. The study showed that manalagi apples (Malus sylvestris mill.) Were widely consumed and had more effect than consuming Shandong pears (Pyrus Bretschneider) on decreasing the plaque index. This can be caused by manalagi fruit containing an average level of quercetin. The content of quercetin varies per fruit. The quercetin content of manalagi apples is higher than Fuji apples, namely 406.57 ± 7.78 mg/ kg.[13]

Similar research was also carried out by Anggreini (2016) that manalagi apple fruit extract contains 76.9mg / 100gram quercetin equivalent compared to Fuji apples which contain 58.31mg / 100-gram quercetin equivalent).[1] Quercetin plays a role by increasing the permeability of bacterial membranes so that it can significantly inhibit the motility of bacteria.[17] However, quercetin is not found in apple flesh, but only in fruit skin, the content of polyphenols or flavonoids in apple skin is higher.[1]

Based on the results of the independent t-test, the p-value was obtained (0.001), which means that there is a difference between consuming Manalagi apples and Fuji apples on the decrease in plaque index in

Madrasah Aliyah Al-Hidayah students. From these results, it can be seen that consuming Manalagi apples is more effective in reducing the plaque index compared to Fuji apples. The results of this study are in line with the research of Handayani et al. (2018) that consuming Manalagi apples is more effective in reducing plaque buildup than Fuji apples.

4. Conclusion

There is a difference in the plaque index before and after consuming Manalagi apples to Fuji apples on the decrease in the plaque index in Madrasah Aliyah Al-Hidayah students. consuming manalagi apples is more effective than fuji apples in reducing the plaque index.

5. References

1. Handayani, DK, Sukrama IDM, and Rahaswanti LWA Comparison of plaque index after consumption of Fuji apples (Malus pumila) and Manalagi apples (Malus sylvestris Mill) in children aged 9 and 10 years at SD Negeri 1 Palung. Bali Dental Journal. 2018; 2 (1): 54- 58.

2. Ministry of Health. Basic Health Research 2018. Jakarta: Ministry of Health, Republic of Indonesia. 2018.

3. Tad A, H. Nakayama-Imaohji, H. Yamasaki, et al. Cleansing effect of acidic L-arginine on human oral biofilm.BMC Oral Health. 2016; 16(1): 40.

4. Haida KE, Cholil, and Aspriyanto. D Comparison of the effectiveness of chewing pears and jicama to decrease the plaque index. Dentino J Dentistry. 2014; 2(1): 24-28.

5. Hiremath SS. Textbook of Preventive and Community Dentistry. 2nd Edition. Elsevier. 2011; 200.

6. Huda H, Aditya G, and Praptningsih R. The effectiveness of the consumption of Apple (*Pyrus malus*) Fuji type on the dental plaque score and salivary pH. J.2 Medal. 2015; (1): 9-13.

7. Penda PAC, SHM.Kaligis, and Juliatri. The difference in plaque index before and after chewing apples. Journal of e-Gigi (eG). 2015; 3(2).

8. Hidayati S, and D. Suyatmi. Effect of chewing apples and red guava on the index debris. Journal of Dental Health. 2016; 3(2).

9. Nurasiko CA, and Amiruddin. The effectiveness of chewing apples and jicama fruit to decrease the plaque index in elementary school students. Journal of AcTion 2017; 2(2): 80- 85.

10. Roza MA. The effect of chewing manalagi apple (Malus sylvestris mill.) On decreasing plaque index. Scientific Publications. Muhammadiyah Surakarta university. 2020.

11. Jannata RH, A. Gunadi, and T. Ermawati. The antibacterial power of manalagi apple peel extract (Malus sylvestris Mill.) Against the growth of Streptococcus mutans (antibacterial activity of Manalagi apple peel (Malus sylvestris Mill.) Extract on the growth of Streptococcus mutans). e-Jurnal Pustaka Kesehatan. 2014; 2(1): 23-28.

12. Utari, P. The difference in the effect of chewing between manalagi apples (Malus sylvestris mill.) And shandong pears (Pyrus bretschneideri) on decreasing plaque index. Publication manuscript. Muhammadiyah Surakarta university. 2020.

13. Cempaka A, Santoso S, and Tanuwijaya. L Effect of processing methods (juicing and blending) on the quercetin content of various local and imported apple varieties (Malus domestica). Indones J Hum Nutr. 2014; 1(2): 14-22.

14. Charde, M-S; A. Ahmed; R-D.Chakole. Apple phytochemicals for human benefits. Int J Pharmacol Res. 2012; 1(2).

15. Sari R, V Kayo. The effectiveness of consuming apples, cucumbers, and jicama to reduce plaque pH. J Poltekkes Jambi. 2013; 8: 6-12.

16. Pratiwi, D-R; D-K-T.Putri; S. Kaidah. The effectiveness of using 50% and 100% betel leaf infusum (Piper betle Linn) as a mouthwash to increase the pH and volume of saliva. Dentino 2014; 2(2): 167–173.

17. Raphael A, Soegiharto S, Evacuasiany E. The effectiveness of gargling apple peel extract manalagi (Malus sylvestris Mill.) 12.5% on decreasing plaque index. Sonde. 2019; 2: 32-43.