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EFFECT OF CHEWING ALOE VERA JELLY CANDY ON SALIVARY FLOW RATE AND pH

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Abstract
The occurrence of caries due to excessive consumption of sweet foods such as candy can be reduced by increasing the salivary flow rate and pH. Mechanical stimulus by chewing aloe vera jelly candy with healthy sweetener could be an alternative way to prevent caries. This study aimed to determine the effect of chewing aloe vera jelly candy on salivary flow rate and pH. Methods: Experimental study with one group pretest and posttest was used. Twenty eight female subjects were given aloe vera and non-aloe vera jelly candy with a healthy sweetener and then instructed to chew 30 times for each candy. Saliva were collected before and after chewing the jelly candy. The salivary flow rate was measured in ml/min and salivary pH were measured using pH meter. Data were analyzed by using paired T-test and independent T-test. Results: This study showed that after chewing aloe vera and non-aloe vera jelly candy, salivary flow rate and pH increased significantly compared to before chewing jelly candy ($p<0.05$). Aloe vera jelly candy showed a higher salivary flow rate but was not significantly different from non-aloe vera jelly candy ($p>0.05$), otherwise the pH value was significantly higher ($p<0.05$). Conclusion: Chewing aloe vera jelly candy can increase salivary flow rate and pH.

Keywords: aloe vera, chewing, flow rate, pH, saliva

INTRODUCTION

Jelly candy is a soft candy with a clear appearance, chewy, elastic texture and enjoyed by many people.[1,2] Excessive frequency of consuming sweet foods can lead to the the development of caries because they contain sucrose as a sweetener. Sucrose can be fermented by the bacteria, leading to a decrease in salivary power of hydrogen (pH) to becomes critical level of 5.5 which can cause enamel demineralization and progression to dental caries.[3,4] Acidic salivary pH needs to be neutralized by the buffering ability of saliva so it can prevent demineralization of the teeth's hard tissue.[3]

Saliva is a complex fluid that plays an important role in maintaining the integrity of the teeth and oral cavity.[5] Increasing the salivary flow rate can protect oral health by moisturizing the oral mucosa and cleaning the oral cavity from debris and acids produced by the bacteria.[4] Chemical stimuli such as sour and sweet tastes and mechanical stimuli such as chewing a high fiber diet and gum can trigger an increase in salivary flow rate.[6,7] Increasing the salivary flow rate can also be achieved by chewing a candy, which helps to maintain oral health, however, the presence of sucrose can lead to negative effects such as dental caries, if it consumed excessively.[8] The negative effects of candy can be minimized by replacing sucrose with healthier natural sweeteners and using herbal plants such as aloe vera. [4,9,10]

Aloe vera is an herbal plant rich in water, fiber, and active ingredients such as acemannan, saponins, and anthraquinones.[11] These ingredients are effective in moisturizing the oral cavity and providing anti-microbial and anti-inflammatory effects. The high water content in aloe vera has been reported to served as a saliva substitute in the treatment of dry mouth.[12,13] Badooei et al (2021) reported that aloe vera mouthwash significantly reduced dry mouth symptoms in people with type 2 diabetes mellitus.[14] Aloe vera can be processed into jelly candy which is quite acceptable in terms of taste, aroma, and elasticity. Aloe vera contain ingredients that may increase salivary flow rate, so research is needed to determine the effect of chewing aloe vera jelly candy on salivary flow rate and pH.

MATERIALS AND METHODS

This study used an experimental one group pretest and posttest design. The procedure of this study has been approved by the Medical and Health Research Ethics Committee, Faculty of Medicine, Sriwijaya University (protocol number 091-2022).

1. Jelly Candy Preparation

The process of making jelly candy begins with peeled, cut, ad cleaned 100 grams of aloevera, then blended it with 150 ml of water. The juice was filtered using the filter cloth. The jelly candy in this study used a healthy sweetener, stevia,

as a sucrose alternative. An amount of 30 ml stevia and 30 gr gelatin powder was added to the juice and then heated at 80º-100ºC degree for 15 minutes until all solids dissolved and the mixture thickened. The mixture was poured into silicone molds and refrigerated at 5°C for 24 hours. The jelly candy was left 1 hours at room temperature then unmolded and packed in a transparent plastic. All procedures were carried out hygienically and ensured to be free of toxic substances.

2. Sample Criteria

This study involved 28 female students from the Departement of Oral and Dental Medicine, Faculty of Medicine, Sriwijaya University, aged 20-23 years. Participants were required to be willing to participate in the study, have a DMFT score of ≤ 3, be in good physical health and have a healthy oral cavity, have no history of systemic disease and not be taking medication that reduce salivary secretion and should not be menstruating and pregnant. Exclusion criteria were smoker or had a history of smoking, undergoing removable or fixed orthodontic treatment, allergic to aloe vera, and fasting. Participants instructed to fill out and sign informed consent after the study procedure were explained.

3. Research Procedure

The study started at 09.00 - 12.00 in a room that has good ventilation and lighting. Participants were instructed to have breakfast first then brush their teeth and were not allowed to eat and drink at least one hour before the saliva collection. All participants were given one aloe vera and one non-aloe vera jelly candy, centrifugation tube, mineral water, a funnel, and a plastic cup. They were instructed to sit upright for 5 minutes, without speaking. and make facial muscle movements as minimal as possible before collecting the saliva. Spitting method was used to collect the saliva and began by collecting the unstimulated salivary flow rates. Particiants were instructed to spit out the saliva every 1 minute for 5 minutes into a 15 ml centrifugation tube. The flow rate was measured in ml/minute and pH was measured with a pH meter. The stimulated salivary flow rate was measured by chewing 2 g of aloe vera jelly candy 30 times simultaneously to the right and left then swallowed after chewing. Subjects were

not allowed to drink or gargle after chewing. After that the subject also chewed the non-aloe vera jelly candy with the same procedure.

4. Statistical Analysis

The measurement results were processed statistically. Data normality was verified by the Shapiro-Wilk test. The data were analyzed using paired T-test, Independent T-test and $p<0.05$ was considered statistically significant.

RESULTS

Shapiro-Wilk normality test was performed and showed p>0,05 which could be assumed that the data were normally distributed. The result of the paired T test are shown in Table 1 and Table 2.

Table 1. Comparison Before and After Chewing Aloe Vera and Non-Aloe Vera Jelly Candy on Salivary Flow Rate

Salivary flow rate	Mean ± SD	*p- value*
Aloe vera jelly candy		
Before	0,479±0,134	0,000
After	0,980±0,295	
Non-aloe vera jelly candy		
Before	0,479±0,134	0,000
After	0,819±0,259	

Tabel 2. Comparison Before and After Chewing Aloe Vera and Non-Aloe Vera Jelly Candy on Salivary pH

Salivary pH	Mean ± SD	*p- value*
Aloe vera jelly candy		
Before	6,553±0,261	0,000
After	6,982±0,154	
Non-aloe vera jelly candy		
Before	6,553±0,261	0,000
After	6,903±0,150	

The results of the paired t-test showed that the average of salivary flow rate and pH after chewing aloe vera and non-aloe vera jelly candy were higher than before chewing ($p < 0.05$) which means that there is a significant difference between salivary flow rate and pH before and after chewing the jelly candy.

Tabel 3. Comparison of Flow Rate and Saliva pH After Chewing Aloe Vera and Non-Aloe Vera Jelly Candy

Variable	Aloe vera jelly candy	Non-aloe vera jelly candy	*p- value*
	Mean ± SD	Mean ± SD	
Salivary Flow rate (ml/menit)	0,980±0,295	0,819±0,259	0,058
Salivary pH	6,982±0,154	6,903±0,150	0,034

The results of the independent T test showed that the average of salivary flow rate and pH after chewing aloe vera jelly candy were higher than those of the non-aloevera group. There was no significant difference in the flow rates after chewing aloe vera and non-aloe vera jelly candy ($p>0.050$) but there was a significant average difference in the salivary pH ($p<0.050$).

DISCUSSION

Result showed that the salivary flow rate increased after chewing aloe vera jelly candy. Shinde et al (2022) stated that the value of salivary flow rate increased significantly after chewing stevia gum for 15 minutes.[15] The increase in salivary flow rate in could be influenced by the mechanical stimuli by chewing the jelly candy, the consistency, and the contents. Chewing aloe vera jelly candy will be recognized by mechanoreceptors in the oral mucosa and passed on to the central nervous system then stimulates the parasympathetic nervous system then triggered the production of large amounts of saliva.[7,16] Chewing can produce a high salivary flow rate and increase it 10-12 times if compared to unstimulated saliva.[18] The chewy and elastic consistency of jelly candy requires high chewing power while being consumed and could stimulate a mechanical stimulus and increase the

salivary flow rate. The large content of water (98.5%) and fiber in aloe vera also has an effect on increasing the salivary flow rate.[19]

The normal range of stimulated salivary flow rate is 1–3 ml/minute. However, in this study, the average flow rate after chewing aloe vera jelly candy was only 0.980 ml/minute, which is below the normal range.[4] This may be due to the consistency of jelly candy used in this study, which was not as chewy and elastic as commercially available jelly candies. As the result, it crumbled easily when chewed, leading to a shorter chewing of approximately 2 minutes.

The result of this study also showed that salivary pH increased significantly after chewing aloe vera jelly candy. The normal average stimulated salivary pH is 7.61 which can increase to 8, while in this study, the average salivary pH after chewing aloe vera jelly candy was 6,982.[5,20] The increase in salivary pH is related to the flow rate and salivary buffer capacity. As the salivary flow rate increase, both the buffering capacity and salivary pH also increase.[3] A decrease in salivary pH can be neutralized by the content of bicarbonate, phosphate, and protein which play a role in the salivary buffer system.[16] Stimulated saliva is reported to have a higher pH with mechanical stimulation than with chemical stimulation, as foods requiring more chewing force increase the salivary flow rate, followed by an increase in salivary pH. Angwarmase et al (2017) also reported a significant increase in salivary pH after chewing gum containing xylitol for five minutes.[4]

This study also used non-aloe vera jelly candy to compare the salivary flow rate and pH after chewing the two types of candy. Chewing aloe vera jelly candy showed a higher salivary flow rate but not significantly different, on the contrary the pH value was significantly higher. The increase in the flow rate of saliva after chewing both aloe vera and non-aloe vera jelly candy can be influenced by the presence of the gelatin, which make the consistency becomes chewy and elastic. This can increase the stimulus of mastication and increase the saliva secretion.[20] The amount of aloe vera in the jelly candy may need to be increased so that the flow rate can increase significantly, but further research is needed. The presence of phosphate content in aloe vera which is one of the buffer components can also contribute to causing the salivary pH value after chewing aloe vera jelly candy to be higher.[21]

The result of this study indicate that aloe vera jelly candy increased salivary flow rate and pH. In this study stevia was used also as an alternative sweetener, so the aloe vera jelly candy with stevia sweetener is a healthy jelly candy and good for health. The aloe vera jelly candy can be made easily in daily life using affordable and easy to obtain ingredients. Chewing aloe vera jelly candy which is known can increase the salivary flow rate and pH is expected to be used by patients with hyposalivation so it can prevent the enamel demineralization, burning mouth syndrome, and periodontitis. The use of aloe vera gel for 5 days in patients at the Intensive Care Unit who were used endotracheal intubation has been reported to reduce dry mouth symptoms, prevent dental plaque formation, and improve oral health.[22] Aloe vera are rich in active substances that are beneficial for oral health so further research is needed on aloe vera jelly candy in maintaining oral health. Furthermore aloe vera jelly candy should be developed so in the future it can be utilized by the wider community as an alternative candy that can improve dental and oral health.

CONCLUSION

The conclusions of this study is chewing aloe vera jelly candy can increase salivary flow rate and pH.

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