The Effect of Gargling Old Coconut Water (Cocos Nucifera L.) on the Salivary Flow Rate and Ph in Students of Sman 10 Fajar Harapan Banda Aceh

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ABSTRACT
Saliva is a complex oral fluid consisting of 99% water that serves as a protector of teeth and mouth against influences from outside and inside oral cavity. Saliva is influenced by several components, including salivary flow rate and pH. Salivary flow rate and pH can change due to mechanical stimulation (gargling) and chemical (taste sensation). Old coconut water contains tannin and minerals with pH of 7.3. This study aims to determine the effect of gargling of old coconut water (*Cocos nucifera L*) toward salivary flow rates and pH in students of SMAN 10 Fajar Harapan Banda Aceh. This research was conducted by collecting saliva by spitting method from subjects. The subject consisted of 41 students. The results of the study analysed using Wilcoxon showed that salivary flow rate had significant differences before and after gargling old coconut water with a value of $p<0.05$. For salivary pH, there was no significant difference before and after gargling old coconut water with a value of $p>0.05$. Based on the results of the study it can be concluded that gargling old coconut water has an effect on salivary flow rate and does not affect salivary pH.

Keywords: Tannin, Mechanical stimulation, Chemical stimulation, Spitting method

1. INTRODUCTION

Saliva consists mainly of 99% water, and 1% of other components such as proteins, immunoglobulins, electrolytes (sodium, potassium, calcium, chloride, magnesium, bicarbonate, phosphate), albumin, urea, and ammonia. Saliva acts to help during the process of digestion of food, cleaning the oral cavity, antibacterial, and buffer which has a high concentration of bicarbonate ion, which plays an important role in neutralizing acids so that it can protect teeth from demineralization in order to maintain dental health especially against caries [1].

Basic Health Research Results, in 2013, the prevalence of people with dental problems was 25.9%, active caries was 46.0%. Prevalence of oral and dental health problems in Aceh Province were 30.5% [2]. Dental caries is caused by acidogenic bacteria, that are able to produce acids such as *Streptococcus mutans* and *Lactobacillus* which are affected by a decrease in salivary flow rate and pH saliva in the oral cavity [3,4].

The salivary flow rate is the total amount of saliva secreted by the major and minor salivary glands [4]. The salivary flow rate serves to remineralize the process of returning mineral ions into the hydroxyapatite structure so that caries does not occur [1]. The salivary flow rate is directly proportional to pH, due to an increase salivary flow rate will increase the buffer capacity of saliva, especially in the arrangement of bicarbonate ions which increases with the speed of salivary secretion [1].

Potential of hydrogen (pH) saliva is a measure of the level of hydrogen ion concentration with acidity and basicity in saliva [5]. In each individual, the velocity of salivary flow rates and pH varies according to the presence or absence of stimulation. The average salivary flow rate at rest 20 mL/h with pH 6.10-6.47 and at mastication 150 mL/h with pH 7.8 [1].

Decreasing salivary flow rates and pH can adversely affect oral health because it can accelerate tooth demineralization and give rise to caries [3]. Gargling is an attempt to increase the salivary flow rate and pH by chemical and mechanical stimulation which functions as an antibacterial and antiseptic [3]. Generally, mouthwash circulating in the market contains alcohol. According to McCullough and Farah, mouthwash containing alcohol can cause a decrease in salivary flow rate which causes the oral cavity to dry

up, and if the amount of saliva decreases also causes salivary pH to be low [6]. The oral cavity with a low salivary flow rate and acidic pH will easier to experience irritation and infection, because there is no adequate protection and lubrication from saliva.

Therefore, another mouthwash that is derived from natural ingredients is needed, one of which can be utilized is coconut water (*Cocos nucifera L.*). Coconut is found in lowland and tropical regions. Indonesia is an agricultural country that occupies the third position as the largest coconut producer in the world, and in Aceh this fruit is easily found. This fruit has been scientifically researched to have efficacy as an antihypertensive drug, antibacterial and can restore lost body fluids [7].

Old coconut water contains tannin, calcium, potassium, sodium, magnesium, iron, phosphorus, and vitamin A, B1, C. Calcium which contains coconut benefits in dental health, namely in the process of remineralization.[8}. According to Ridwan, coconut water old is water that has a natural alkaline pH. Tanin found in old coconut water is a subclass of polyphenols which will cause a bitter taste that will stimulate taste and salivary secretion by the major and minor salivary glands, consequently salivary secretion increases the flow rate and pH of the aliva will increase [8].

This research was conducted on students of SMA Negeri 10 Fajar Harapan, because the high school was a superior school, with students paying more attention to and maintaining the condition of the oral cavity. Students of class X and XI are considered to have a state of academic stress that is not too heavy, this condition is due to students of class XI and XII not yet taking the national exam. Based on the description above, researchers were interested in conducting research on gargling with old coconut water. This is done to determine the effect of gargling of old coconut water on the salivary flow rate and pH.

2. MATERIALS AND METHODS

This research was conducted in September 2018. The subjects of this study were students of SMA Negeri 10 Fajar Harapan Banda Aceh. The sampling technique used was purposive sampling. This type of research is analytical with Analytic Experimental design Pre-test and Post-test Control Group Design.

2.1. Selection Of Research Subject

Before conducting research the subject was collected and given direction to fill out the questionnaire [9,10], regarding identity data including name, age, gender, and other data needed to see inclusion and exclusion criteria. Subjects who met the inclusion criteria and were willing to take part in the study were given an informed consent sheet [11]. The study was conducted for four days. The first day the subject was asked to fill out a questionnaire form and a DASS form. The second day the subjects who entered the inclusion criteria will be given informed consent. Subjects were divided into two groups. The first group subjects were collected on the third day to take part in the study. The fourth day of the study, salivary was collected for the second group. Preparations begin at 08.00 a.m. and then at 09.00-11.00 a.m. a collection of saliva is conducted [12].

2.2. Measurement Of Salivary Flow Rate And Ph Before Gargling Old Coconut Water

Research subjects were asked to brush their teeth, not eat, drink, smoke and exercise within 1 hour before taking saliva. Salivary collection is carried out starting at 09.00 a.m. Subjects are not allowed to speak, move the tongue, and swallow during collection of saliva. Subjects were asked to sit with the position of the back upright, the head bent and the right hand holding the measuring cup. Salivary taked in a total time of 5 minutes, then the subject was instructed to spitting the saliva collected in the mouth into the measuring cup every 1 minute. Furthermore, the salivary flow rate was measured, by calculating the amount of saliva collected in the measuring cup divided by the time used to collect saliva. Then, the pH measurements of saliva were carried out using a digital pH meter, by inserting a pH meter electrode and looking at the numbers printed on the pH meter. Data can be recorded on the prepared data sheet [8,11,12].

2.3. Old Coconut Water Preparation

Old coconut water used comes from old coconut with the criteria of brown skin, thick flesh, and white water. The varieties used are long coconut. Coconut is taken from the Seulimum area, Aceh Besar as many as 30 pieces. First, the coconut fruit is separated between coir and shell. Furthermore, the coconut shell section containing old coconut water is split using a coconut cutter. Then coconut water is filtered and stored in a container.

2.4. Gargling Mineral Water

The research subject was instructed to gargling with 20 mL of mineral water for 30 seconds to neutralize saliva, to be accurate in subsequent measurements [6,8,12].

2.5. Measurement Salivary Flow Rate And Ph After Gargling Old Coconut Water

Subjects were distributed 20 mL of old coconut water then instructed to gargle old coconut water for 30 seconds [6,8]. Furthermore, saliva was held in the mouth for 1 minute under closed lip, then spitting in measuring cup every1 minute. Taking saliva is done for 5 minutes. Position of the subject when taking saliva the position of the backrest is upright, the head is bent and the right hand holds the measuring cup. Furthermore, the salivary flow rate was measured, by calculating the amount of saliva collected in the measuring cup divided by the time used to collect saliva. Then, pH measurements of saliva were carried out using a digital pH meter, by inserting a pH meter electrode and looking at the numbers printed on the pH meter. The data obtained is recorded on the data sheet that has been prepared

2.6. Calibrate Ph Meter

The plastic cover of the electrode is opened, then rinsed with deionized water (ion-free water) and dried using tissue paper. Turn on the digital pH meter by pressing the ON/OFF button. The electrode was inserted into a pH 7 buffer solution, turning the electrode so that the buffer solution was homogeneous. Leave it for a while until the value on the display does not change. Press cal key to start the calibration, then a CAL will appear on the screen. Press the hold button to perfect the calibration with the buffer. Lift the electrode from the buffer solution, then rinse with deionized water several times and dry it with tissue paper, the pH meter is ready to use.Furthermore, the measurement of salivary pH is carried out. Prepare the sample to be measured in pH. Open the plastic electrode lid, then turn on the digital pH meter by pressing the ON/OFF button. Enter into the sample, then rotate so that the solution is homogeneous. Leave until the numbers on the screen change with the value measured by the pH. Turn off the digital pH meter by pressing the ON/OFF button.

2.7. Statistic Analysis

Data analysis was performed with SPSS software. The research data were analyzed by the Wilcoxon test with results at the salivary flow rate $p > 0.05$ and $p < 0.05$ at the salivary pH to see the effect of gargling old coconut water on salivary flow rates and pH in SMAN 10 Fajar Harapan Banda Aceh.

3. RESULTS

This research was conducted to see the effect of gargling of old coconut water on salivary flow rate and pH. From the results of the subject selection on students of SMA Negeri 10 Fajar Harapan Banda Aceh there were 41 students. Subjects were selected by giving a subject selection questionnaire and assessment of Depression, Anxiety, and Stress Scale (DASS). Subjects who met the inclusion criteria provided informed consent that was read and signed by the research subjects with the student witnesses in the student section. Collection of flow rate and pH of saliva before gargling old coconut water and after gargling old coconut water as a duration of $\pm$ 5 minutes for each treatment. Salivary collection is carried out by the spitting method. The process of gargling old coconut water (Cocos nucifera L.) using old coconut water as much as 15 ml for 30 seconds.

After obtaining data on the results of examination of salivary flow rate and pH before gargling old coconut water and after gargling old coconut water, then the normality test was carried out using the Shapiro-Wilk test. Based on the Shapiro-Wilk test, it is known that the flow rate data and the salivary pH obtained are not normally distributed. Next, the data transformation is done by using the Log10 test for data that is not normally distributed. Then, a Shapiro-Wilk test is performed on new data from data transformation. Based on the test, the data obtained is still not normally distributed. Because the data is not normally distributed, the data must be analyzed using a non-parametric test, Wilcoxon test.

Table 1. Average salivary flow rate.

Salivary Flow Rate	Average
Before gargling old coconut water	0,48 mL/min
After gargling old coconut water	0,62 mL/min

Table 2. Effect of old coconut water gargling on salivary flow rate.

Effect of old coconut water gargling on salivary flow rate	Total
Increase salivary flow rate	28 subjects
Decrease salivary flow rate	9 subjects
There is no change in the saliva flow rate	4 subjects

Table 3. Average salivary pH.

Salivary pH	Total
Before gargling old coconut water	6,9
After gargling old coconut water	7

Table 4. Effect of gargling old coconut water on salivary pH.

Effect of gargling old coconut water on salivary pH	Total
Increase in salivary Ph	21 subject
Decrease in salivary pH	17 subject
There is no change in the saliva pH	3 subject

Table 5. Wilcoxon statistics test on salivary flow rate and pH.

	Value p
Statistics test of salivary flow rate after gargling old coconut water - salivary flow rate before gargling old coconut water	0.002
Statistics test salivary pH after gargling old coconut water - salivary pH before gargling old coconut water	0.994

4. DISCUSSION

The results were obtained from students of SMAN 10 Fajar Harapan Banda Aceh. After obtaining the results of research data, data processing using parametric test. T-test paired can not be done because the data is not normally distributed, so the data is processed using Wilcoxon non-parametric test. The results obtained were significant differences in the flow rate of saliva before and after gargling of old coconut water. The treatment given to the subject showed an increase in the flow rate of saliva after gargling old coconut water.

This is consistent with Indriani's research on differences in salivary flow rates affected by mechanical and chemical stimuli [8]. And also in line with Simatupang's research on the effects of gargling jamblang juice (*Syzygium cumini*) on salivary flow rates [11]. Increased salivary flow rates are caused by mechanical stimuli in the form of gargling and chemical stimuli originating from old coconut water. [8]. Stimulated salivary reflexes occur when chemoreceptors or pressure receptors in the oral cavity

respond to the stimulus [1] When there is a stimulus, these receptors start impulses in afferent nerve fibers that carry information to the salivary center in the medulla of the brain stem [1] The salivary center then sends impulses through the parasympathetic nerve all the way from the superior inferior and inferior salivary nuclei of the brain stem to the salivary glands to increase salivary secretion [13]. Chewing or gargling can stimulate secretion saliva for their existence manipulation of pressure receptors found in the mouth [1].

From the results of this study, it was proven that the tannin content in old coconut water can stimulate salivary glands to increase salivary secretion. In addition, the high mineral content in old coconut water is also thought to stimulate the salivary glands to increase the rate of salivary flow.

In addition, this study showed no significant differences in salivary pH before and after gargling of old coconut water. The first measurement, namely to measure the pH of unstimulated saliva obtained an average pH of 6.9 included in the neutral category and subsequent measurements, namely to measure the pH of saliva after stimulation obtained an average pH of 7 which is included in the neutral category. The results of this study are in line with Jannah's research on the effect of gargling mineral water after consuming carbohydrites food [14]. And also this study is in line with Rawung's study of the effect of gargling alcoholic mouthwash on salivary pH which states there is no significant difference before and after gargling alcoholic mouthwash and pH saliva remains in a neutral state, because the mouthwash is neutral [6].

The number of respondents changed from alkali to neutral 6 people, acid to neutral 7 people and remained neutral 15 people. This is due to the low concentration of bicarbonate ions in saliva. An increase in bicarbonate ions occurs when an increase in salivary flow rate to help neutralize acid [19]. In this study, the stimulus of old coconut water given is neutral which is known to have a pH of 7.3, so it does not trigger an increase in bicarbonate ions.

As is well known, neutral salivary pH can clean acids produced by acidogenic microorganisms, thereby preventing caries and enamel demineralization [15]. Under conditions neutral salivary pH can also maintain the balance of minerals contained in salivary buffering capacity, and can prevent calculus caused by plaque calcification due to pH saliva, and the concentration of calcium and phosphate ions is quite high [12]. Based on the results of research that has been done it can be concluded that the hypothesis in this study was rejected.

5. CONCLUSION

Old coconut water (*Cocos nucifera L.*) can increase rate of salivary flow and neutralizing salivary pH. Increased salivary flow rate serves to remineralize the process of returning mineral ions into the hydroxyapatite structure so that caries does not occur and a neutral salivary pH can clean acids that are acidised by acidogenic microorganisms and maintain mineral balance.

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