

Effectiveness of rebon shrimp crackers on increasing salivary calcium ion concentration of students in Percobaan Public Elementary School Medan



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Abstract Rebon shrimp is a local food in Bagan Serdang Village that has a very high nutritional content. One hundred grams of dried rebon contains 2.306 mg of calcium or equal to 16 times the calcium of 100 grams of cow's milk. Calcium takes part in preventing demineralization by keeping the pH neutral. The aim of this study was to evaluate the effectiveness of rebon shrimp crackers to increase salivary calcium ion among elementary school children. This type of research is an experimental study with pre and post test group design to obtain the average calcium ions in saliva before and one month after consuming rebon shrimp crackers. The minimum sample size were 40 samples, which 20 samples were included in the intervention group who were given each day one pack each for 30 days during school breaks and supervised by teachers, while 20 samples were included in the control group and were not given crackers. Saliva sampling was carried out using the unstimulated method. The concentration of salivary calcium ions before and after given the intervention was measured using paired t test and to analyze the difference in the concentration of salivary calcium ions between the two groups using an unpaired t test. There was a significant difference in the concentration of salivary calcium ions between the group given rebon shrimp crackers and the group that was not given rebon shrimp crackers ($p=0.034$). There was a significant increase in the concentration of salivary calcium ions before and after being given rebon shrimp crackers ($p=0.000$), whereas in the untreated group that was not given crackers there was no significant increase ($p=0.496$). It can be concluded that the risk of dental caries can be reduced by consuming local food ingredients that are high in calcium and minerals.

Keywords: rebon shrimp, calcium, caries

1. Introduction

In Indonesia, dental caries ranks first as the most common chronic disease in school-age children. Based on Indonesia Basic Health Research 2018, the prevalence of dental caries in Indonesia reached 88.8 percent, and the national DMF-T index was 7.1 with D-T = 4.5; M-T=2.5; F-T=0.1; it can be interpreted that tooth decay in Indonesia is 710 teeth per 100 people (Kemenkes RI, 2018). According to the results of Basic Health Research in 2018, the proportion of people with dental and oral problems in North Sumatra was 54.6%, while that in Medan was 52.22%. From a preliminary study in Bagan Serdang village, the prevalence of caries was 81.18% (Yanti, 2023).

Usually, children who enter school age are more at risk of experiencing high caries due to the behavior of consuming sweet snacks at school. Research conducted by Rahmati in 2016 found that the habit of eating sweet and sticky-textured or cariogenic foods/snacks is the main cause of caries in school-age children. The American Heart Association (AHA) explains that children consume the most sugar, where children aged one to three years consume as much as 12 teaspoons of sugar a day, and children aged four to eight years consume as much as 21 teaspoons of sugar in a day (Ramayanti & Purnakarya, 2013).

Dental caries is a complex disease because it is multifactorial, infectious, and chronic, starting with acid that destroys tooth minerals. Early lesions at the demineralization stage occur with loss of calcium, phosphate, and carbonate to create surface lesions (white spots). This stage can be prevented by reducing pathological factors and increasing protective factors (Rahayu, 2013).



Remineralization is the process of precipitating calcium and phosphate ions from the environment into demineralized enamel crystals. The remineralization stage can occur when the pH is neutralized and Ca^{2+} and PO_3^- ions are present in sufficient quantities (Rahayu, 2013).

Various efforts to overcome dental caries have been carried out by the government, especially for elementary school children with the UKGS (School Dental Health) program. The aim of the program is to maintain the dental and oral health of elementary school children through dental and oral health education, mass toothbrushing movements, fluoride rinses, and controlling the dental and oral health of all students. In addition, consuming foods high in calcium can prevent caries.

Calcium is the most abundant mineral in the body; 99 percent of total calcium is found in hard tissues, especially in hydroxyapatite, and only a small amount is found in extravascular fluid plasma. (Bolland et al., 2015) Calcium also helps prevent the demineralization of enamel by keeping the salivary pH neutral, namely, 6.7-7.4 (Almeida, 2008).

Based on the potential of a local food source in the form of rebon shrimp, which is rich in calcium of 2,306 mg, equal to 16 times calcium in 100 grams of cow's milk (in 100 grams of dried rebon shrimp), it is supported by the high problem of dental caries in elementary school children in Bagan Serdang Village and the limited research on caries prevention in the community using local food ingredients; therefore, researchers want to investigate the effectiveness of rebon shrimp crackers in increasing the concentration of calcium ions in saliva in elementary school children in different Kota Medan.

Dental and oral health screening of elementary school students in Bagan Serdang Village was carried out before the rebon shrimp crackers were given (Yanti, 2023). A preliminary study using rebon shrimp crackers in Bagan Serdang village showed that there was a significant increase in salivary ion calcium in children, which is why this study aimed to examine rebon crackers again in Kota Medan.

2. Materials and Methods

This type of research is an experimental study with a pre- and posttest group design to obtain the average calcium ions in saliva before and one month after consuming rebon shrimp crackers. One pack of rebon shrimp crackers is 35-40 grams, and each gram contains 6.32 mg of calcium.

The location of this research is Percobaan Public Elementary School in Medan. Based on the sample size calculation for the hypothesis test, a minimum sample size of 40 samples was obtained, of which 20 samples were included in the intervention group and were given one pack each day for 30 days during school breaks and supervised by teachers, while 20 samples were included in the control group and were not given crackers. The sampling used a purposive sampling method, with inclusion criteria, such as between the ages of 8 and 12 years, decay of <5 teeth, parental consent, and willingness to be examined, while the exclusion criteria were an uncooperative student.

First, dental health education was given to the children, and then the decay score was examined to screen the respondents. After that, the respondent's saliva was taken, and then the concentration of calcium ions in saliva was measured before and after one month of being given the intervention. Saliva sampling was carried out using the unstimulated method. Finally, the saliva samples were brought to the Laboratory for Industrial Research and Standardization in Medan to measure the concentration of calcium ions in the saliva.

A normality test was carried out using the Shapiro–Wilk test, and the results showed normally distributed data ($p > 0.05$). Then, the mean concentration of salivary calcium ions before and after the intervention was measured using a paired t test, and the difference in the mean concentration of salivary calcium ions between the two groups was analyzed using an unpaired t test using SPSS. This research has passed ethical clearance with reference number 1182/KEPK/USU/2022 from the Ethics Committee of Universitas Sumatera Utara, Medan, Indonesia.

3. Results

The characteristics of the respondents show that there are more students aged 9 years (75%) than students aged 10 years (25%). Respondents consisted of 47.5% women and 52.5% men (Table 1).

Table 1 Characteristics of Respondents of Percobaan Public Elementary School in Medan.

Characteristics of Respondents	n	%
Age (years)		
9	30	75
10	10	25
Gender		
Females	19	47.5
Males	21	52.5

The average Decay score was 1.65 ± 1.40 . The Decay score was higher for girls (1.73 ± 1.48) than for boys (1.57 ± 1.35) (Table 2).

Table 2 Decay score of Percobaan Public Elementary School students in Medan.

Gender	n	Control Group				Consumed the crackers		Total Decay Score	
		Decay Score		Decay Score		Sd	Sd	x̄	Sd
		x̄	Sd	x̄	Sd				
Females	19	2.22	1.20	1.32	1.53	1.73	1.48		
Males	21	1.90	1.30	1.20	1.30	1.57	1.35		
Total	40	2.05	1.23	1.25	1.48	1.65	1.40		

Table 3 below shows the results of the normality test for all samples in the initial salivary calcium sample group, which had a significance value of $p=0.547$ ($p>0.05$), indicating that the data were normally distributed. The results of the normality test in the final salivary calcium group had a significance of $p=0.333$ ($p>0.05$), indicating that the data were normally distributed.

Table 3 Sample Normality Test.

	Shapiro-Wilk		
	Statistic	n	Sig.
Initial salivary calcium group before treatment	0.976	40	0.547
Final salivary calcium group after treatment	0.969	40	0.333

The initial test results for measuring the concentration of calcium ions in saliva before being given intervention showed that there was no significant difference in the concentration of calcium ions between the group given the crackers and the group not given the crackers ($p=0.405$) (Table 4).

Table 4 Mean saliva calcium ion concentration before treatment.

Group	n	Mean Concentration of Calcium Ions (mg/L)	Statistical test results
Consumed the crackers	20	0.376 ± 0.010	p=0.405
Control Group	20	0.378 ± 0.006	

Then, a test was carried out after students consumed crackers compared to those who did not eat crackers. There was a significant difference in salivary calcium ion concentration in the group consuming crackers and the group not receiving crackers after being given treatment ($p=0.034$) (Table 5).

Table 5 Mean saliva calcium ion concentration after treatment.

Group	n	Mean Concentration of Calcium Ions (mg/L)	Statistical test results
Consumed the crackers	20	0.383 ± 0.008	p=0.034
Control Group	20	0.377 ± 0.008	

There was a significant increase in the concentration of salivary calcium ions before and after the treatment ($p=0.000$), whereas in the untreated group, there was no significant increase ($p=0.496$) (Table 6). This means that this shrimp cracker is effective in increasing the concentration of calcium ions in saliva.

Table 6 Mean saliva calcium ion concentration before and after treatment.

Group	n	Mean Concentration of Calcium Ions (mg/L)		Mean Difference (mg/L)	Statistical test results
		Before	After		
Consumed the crackers	20	0.376 ± 0.006	0.383 ± 0.008	0.0076	p=0.000
Control Group	20	0.378 ± 0.010	0.377 ± 0.008	0.0005	p=0.496

4. Discussion

Teeth play an important role in the development of children. Caring for the teeth and mouth of school children is necessary. Policies are made regarding this by increasing promotive, preventive, and curative efforts in school-age children (6 to 12 years) because this age is the time for permanent teeth to grow. In general, children who enter school age have a high risk of dental caries because they consume sweet snacks at school. All types of carbohydrate-based foods are one of the causes of dental caries; therefore, the amount and frequency at which a person consumes carbohydrates need to be considered for dental and oral health and nutritional intake (Herijulianti et al., 2002; Retno & Murdijati, 2014).

Snacks that contain a large amount of sugar will cause the salivary pH to be low so that dental caries or cavities can easily occur. Tooth enamel mineralization is influenced by salivary pH. Low salivary pH will cause hydrogen ions to increase so that it can damage the hydroxyapatite bonds in teeth and will dissolve enamel crystals. This partial or complete loss of



enamel minerals is known as demineralization. When demineralization occurs, microporosity forms on the tooth enamel surface. Severe demineralization will cause the formation of white spots, which can lead to dental caries. If demineralization occurs continuously for a long time and is stimulated by bacteria, then dental caries will occur (Widyaningtyas et al., 2014).

The demineralization factor can be reduced by making dietary changes, for example, by consuming foods that contain large amounts of calcium (Heymann & Swift, 2006). Foods that contain large amounts of calcium will trigger the exchange of calcium ions from food to saliva so that the salivary pH will increase and can prevent cavities. One of the foods that is high in calcium is rebon shrimp (Ramayanti & Purnakarya, 2013).

Rebon shrimp is one of the marine products from a type of crustacean with a small size compared to other types of shrimp. The small size makes this type of shrimp called "rebon". In foreign countries, shrimp rebon is known as shrimp paste. Rebon prawns are zooplankton with a length of 1-1.5 cm consisting of groups namely, Mysidocera acetes and peraeidae larvae, which are found around estuaries (Sulistiyono et al., 2017). This shrimp is one of the raw materials used to make shrimp paste. This type of shrimp is easier to find in the form of shrimp paste or dried than in fresh form.

Rebon is a source of protein but is not as well known as beef, fish, chicken or other shrimp. One hundred grams of dried rebon contains 59.4 grams of protein but has a low fat content of 3.6 grams. The advantages of this rebon are found in the content of calcium, phosphorus, and iron. One hundred grams of dried rebon contains 2,306 mg of calcium equivalent to 16 times the calcium content of 100 grams of cow's milk. The phosphorus content is 625 grams, and the iron content is 21.4 grams or the equivalent of eight times the nutritional content of 100 grams of beef (Persagi, 2018).

Shrimp is Indonesia's abundant marine wealth and is a food ingredient from the sea that is not durable. Therefore, it needs handling to prolong its use. Several methods can be used, including making shrimp paste, dried shrimp, and prawn crackers. Making prawn crackers, in addition to increasing the duration of using prawns, is also a way to add variety to the use of prawns, where prawns are animals that contain very high amounts of protein needed by humans. With these prawn crackers, people who do not like eating prawns directly can also enjoy prawns with prawn crackers (Nasution et al., 2019).

In the initial research that had been done before in Bagan Serdang Village, the measurement results showed the high nutritional content of rebon shrimp, especially phosphorus, protein, and calcium substances. One hundred grams of wet rebon shrimp contains 154 mg of calcium, and 150 mg of calcium is contained in dry rebon shrimp. The high content of calcium in rebon shrimp can be used as a way to prevent cavities by processing it into one of the functional foods that children like, namely, crackers. The shape of the crackers was chosen because when consumed, a chewing process occurs that stimulates the exchange of calcium ions from the crackers to the saliva so that it can increase the concentration of calcium ions in saliva, increase salivary pH and prevent demineralization (Yanti et al., 2019; Yanti et al., 2022).

The form of crackers was chosen because when consumed in the mouth, it can stimulate saliva with the chewing process so that there is an exchange of calcium from the crackers to the saliva of the oral cavity. Crackers are also a type of food that is cheap, easy to make, tasty and effective and is liked by children.

The same previous study on the effectiveness of rebon shrimp in preventing dental caries in elementary school students in Bagan Serdang Village with a total sample of 60 people was carried out, and the results showed a significant increase in salivary calcium ion concentration before and after being given crackers rebon shrimp ($p = 0.0001$), whereas in the untreated group, there was no significant increase ($p = 0.156$) (Yanti et al., 2022).

This research was conducted on different elementary school students, namely, Percobaan Public Elementary School, which has a different socioeconomic status from Elementary School in Desa Bagan Serdang, so that the effectiveness of rebon prawn crackers could be tested. The results showed that there was a significant difference in salivary calcium ion concentration in the group consuming crackers and the group not receiving crackers after being given treatment ($p=0.034$). There was a significant increase in the concentration of salivary calcium ions before and after the treatment ($p=0.000$), while there was no significant increase in the untreated group ($p=0.496$). This means that this shrimp cracker is effective in increasing the concentration of calcium ions in saliva. It is hoped that these rebon prawn crackers can be an alternative for preventing dental caries that is easy, inexpensive and has high nutritional value so that it can be used by the community.

5. Conclusions

From the results of the research above, we can conclude that the risk of dental caries can be reduced by consuming local food ingredients that are high in calcium and minerals.

Ethical Considerations

This research has passed ethical clearance with reference number 1182/KEPK/USU/2022 from the Ethics Committee of Universitas Sumatera Utara, Medan, Indonesia.

Conflict of Interest

The authors declare no conflicts of interest.

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