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Research Article

Differences in Saliva pH before and after Drinking Packed Cow's Milk in Children Aged 6 -12 Years

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Abstract

Background: The main factors that cause dental caries are the host (teeth and saliva), substrate (food), microorganisms, and time. Saliva as a host factor plays a role in protective mechanisms. Several factors cause changes in salivary pH to include the average salivary flow rate, oral microorganisms, salivary buffer capacity, and frequently consumed foods and beverages; One of them is milk. Objective: To investigate the differences in salivary pH before and after drinking packed cow's milk in children aged 6-12 years old. Methods: Quasi-experimental research methods were conducted using Pretest and Posttest Control Group Designs. The instruments in this study used a pH meter. Statistical Test using Student t-Test. Results: There is no difference in the average pH of saliva 0 minutes after drinking cow's milk packaged brand A and brand B (p= 0.772 and p=0.384, respectively). There is an average difference in salivary pH 5 minutes after drinking cow's milk packaged brand A and brand B (p=0.001). The results of the analysis between 5 minutes after drinking liquid milk packaged brand A with brand B there was a significant difference in reducing the pH of saliva (p = 0.001). Conclusion: There is a difference in salivary pH before and after drinking packed cow's milk in children aged 6-12 years.

Keywords: Salivary pH, Packed cow's milk, Elementary School

INTRODUCTION

Dental and oral health is one of the crucial factors in the growth and development of children and can affect the quality of life of a child. One of the dental and oral health problems that often occur in children is dental caries. Dental caries is one of the infectious diseases of the hard tissues of the teeth.[1] The World Health Organization/WHO reveals that oral health is crucial to improve the quality of life, namely a state of being free from problems with oral disorders, throat cancer, mouth and wound infections, periodontal (gum) disease, tooth decay, tooth loss, and other diseases.[2] In the Special Region of Yogyakarta, the number of cavities/people with dental and oral problems, according to the 2018 Basic Health Research, was 47.7%, higher than the national average of 45.3%.[4]

The main causes of dental caries are the host (teeth and saliva), substrate (food), microorganisms, and time. Dental caries is formed when there is an interaction between these four factors.[5,6] Saliva as a host factor plays a role in protective mechanisms that maintain the normal flora of the oral cavity and tooth surface, namely bacterial cleansing, antibacterial activity, buffers, and remineralization. Saliva also has a buffer system that functions to neutralize acidic conditions that arise due to plaque formation or acidic foods and drinks.[7]

Saliva is a thick fluid produced by the salivary glands, parotid glands, sublingual glands, and submandibular glands, which are located under the tongue near the cheek muscles and near the palate. Saliva contains 99.5% water.[8]

Saliva is a complex oral fluid, consisting of a mixture of secretions from the major and minor salivary glands found in the oral mucosa with a potential hydrogen/salivary pH ranging from 5.6 to 7.0. Several factors that cause changes in salivary pH include the average salivary flow rate, oral microorganisms, salivary buffer capacity, and frequently consumed foods and beverages; One of them is milk. Milk contains many food substances such as carbohydrates, proteins, minerals, and vitamins.[9]

Research conducted by Warti[10] stated that there was no significant decrease in salivary pH at 5 minutes, 10 minutes, and 30 minutes after consuming packed cow's milk. Research conducted by Masih et al. [11] concluded that there was a decrease in salivary pH after consuming plain milk, sweetened milk, and formula milk. Research on changes in salivary pH after consuming milk was also carried out, who compared the effect of various flavors of milk on salivary pH. The results showed that there was a decrease in salivary pH after consuming various flavored milk, but the salivary pH returned to normal after 30 minutes.

MATERIALS AND METHODS

The method used in this study is a quasi-experimental Pretest and Posttest with a Control Group Design. The instrument used is a pH strip. This study with a sample of 84 respondents, consisting of 45 boys and 39 girls. This method was used to examine the differences in saliva pH before and after drinking packed cow's milk in children aged 6 -12 years

old. The location of this research was Kemusuk Kidul Argomulyo Sedayu Bantul, Yogyakarta, Indonesia.

Respondents have divided into 2 groups; the First group was the intervention by using drinking packed cow's milk brand A, for 0 minutes and the Second group was the intervention by using drinking packed cow's milk Brand A after 5 minutes. The 2 groups also were intervention by using drinking packed cow's milk brand B. Brand A milk contains fatter than brand B milk. The record of pH saliva was conducted before and after drinking packed cow's milk.

To determine whether the research data is normally distributed or not, the data normality test was carried out using the Kolmogorov-Smirnov test. To determine the difference in salivary pH of the group before and after drinking milk, the data were analyzed using the Paired T-Test. The difference in salivary pH of the group drinking milk brand A and brand B, the data were analyzed using the Independent T-Test.

RESULTS

The result of the difference in salivary pH of the group drinking milk brand A showed in Table 1 and the difference in salivary pH of the group drinking milk brand B showed in Table 2.

Table 1: Average salivary pH of Respondents Before and After Drinking Packed Cow's Milk Brand A

Variable	N	Salivary pH		Difference
		Before	After	
Group 0 minutes	42	7.12	7.04	0.08
Group 5 minutes	42	6.86	6.31	0.55

According to Table 1. the pH value of saliva in the group 5 minutes after drinking packed cow's milk decreased from 6.86 to 6.31 with a difference of 0.55.

Table 2: Average Saliva pH of Respondents Before and After Drinking Liquid Cow's Milk Brand B.

Variable	N	Salivary pH		Difference
		Before	After	
Group 0 minutes	42	6.88	6.90	0.02
Group 5 minutes	42	6.88	6.46	0.42

Table 2 provided that the 0-minute group after drinking packed cow's milk experienced an increase in pH from 6.88 to 6.90 with a difference of 0.02. The results of Paired T-Test for analysis before and after drinking packed cow's milk brand A showed in Table 3 and brand B showed in Table 4.

Table 3: Results of Paired T-Test Analysis Before and After Drinking Packed Cow's Milk Brand A.

Time	*Asymp Sig.	A	Description
0 minutes	0.384 >	0.05	No difference
5 minutes	0.001 <	0.05	There is a difference

Paired T-Test

Table 3; the value of Asymp.Sig (p) 0 minutes after drinking milk was 0.384>0.05, which means that there was no difference in the average salivary pH before and after drinking brand A packed cow's milk, or there was no effect 0 minutes after drinking packed cow's milk on salivary pH. The value of Asymp.Sig (p) 5 minutes after drinking brand A liquid cow's milk was 0.001 < 0.05, meaning that there was a difference in the average salivary pH before and after 5 minutes of drinking brand A packed cow's milk, or there was an effect of 5 minutes after drinking packed cow's milk on the pH of the respondent's saliva.

The analysis before and after drinking brand B-packed cow's milk can be seen in Table 4. The results of the independent T-Test of salivary pH between packed cow's milk brand A and brand B, showed in Table 5.

Table 4: Results of Paired T-Test Analysis Before and After Drinking Brand B packed cow's milk

Time	*Asymp Sig.	A	Description
0 minutes	0.772 >	0.05	No difference
5 minutes	0.001 <	0.05	There is a difference

Paired T-Test

Table 4, the value of Asymp.Sig (p) 0 minutes after drinking brand B milk was 0.772 > 0.05, meaning that there was no difference in the average salivary pH before and after drinking brand B-packed cow's milk. Asymp value. Sig (p) 5 minutes after drinking brand B milk is 0.001 < 0.05, meaning that there was a difference in the average salivary pH before and 5 minutes after drinking milk or there was an effect 5 minutes after drinking brand B packed cow's milk on salivary pH.

Table 5: Independent Sample T-Test 0 minutes and 5 minutes after drinking brand A and brand B milk.

Time	*Asymp Sig.	A	Description
0 minutes	1.000 >	0.05	No difference
5 minutes	0.258>	0.05	No difference

**** Independent Sample T-Test***

In table 5, it was identified that between 0 minutes of brand A milk and 0 minutes of brand B milk there is no significant difference, sig = 0.772 > 0.05, 5 minutes after drinking packed cow's milk showed no significant difference, sig = 0.258 > 0.05. The results indicate that after 0 minutes of drinking brand A milk, as well as after 0 minutes of drinking brand B milk did not decrease the salivary pH.

DISCUSSION

Based on the results of the study (table 1) and (table 2), the pH value of saliva in the 0-minute group after drinking packed cow's milk decreased from 7.12 to 7.04, with a difference of 0.08 (group A) and increased from 6.88 to 6.90 with a difference of 0.02 (group B). The salivary pH after drinking brand A liquid cow's milk decreased salivary pH but increased in consuming brand B liquid cow's milk. This is because brand A milk contains more fat than brand B milk that was consumed and would be solved into fatty acids by the bacteria, which can also lower the salivary pH value. The results of this study are in accordance with the research that states that the decrease in salivary pH after drinking pure cow's milk is less than powdered cow's milk (formula milk).[9]

It can be concluded that drinking milk can increase the salivary pH; increasing the salivary pH can help prevent dental caries, as well as strengthen bones and teeth because milk contains calcium. The results of this study are in accordance with research results [12], that milk and its derivative products contain calcium which is the main mineral of bones and teeth. Milk is an excellent medium for probiotic bacteria because its buffering capacity increases the survival of probiotic bacteria and can neutralize acidic conditions.

The pH value of saliva in the group 5 minutes after drinking packed cow's milk decreased from before drinking milk, from 6.86 to 6.31 with a difference of 0.55. Even though there was a decrease in pH, it did not drop drastically to the critical pH (5.5), so it did not damage the tooth surface or demineralization occurred. As for the decrease in salivary pH 5 minutes after drinking milk, it is possible that fermentation occurs from the carbohydrate content in the milk. The results of this study are in accordance with research [12], that milk is non-cariogenic and has a protective effect against sugar when consumed together. Milk is also amphoteric which means it can fall between acidic and basic properties. Naturally, the pH of milk ranges from 6.5 to 6.7.

The results of the study (table 3) and (table 4), that was no significant/no effect 0 minutes after drinking milk on salivary pH (Group A, p=0.384) and there was no significant difference/no effect 0 minutes after drinking milk on salivary pH (Group B, p=0.772). The results of this study are in accordance with research[1] that the pH value of subjects who consumed UHT milk increased by an average of 1.3 causing the subject's oral condition to be more alkaline. These results are in accordance with the research. The protein content contained in UHT milk allows the release of more ammonia-alkaline substances, there for the pH value of the subject's saliva increases. Amino acids (NH2) contained in proteins will be converted into ammonia alkaline substances (-NH2+H+ NH3) and can increase the pH value of saliva. [16] It is also in accordance with research, that if the salivary flow rate increases, the bicarbonate ion concentration will also increase there for the buffer capacity will be better and the salivary pH value will be stable or higher. These results are in accordance with the research that bacteria will decompose carbohydrates into lactic acid, butyric acid, and aspartic acid, this can cause a decrease in the pH value of saliva.[1]

The Paired T-Test averaged saliva pH of 5 minutes after drinking liquid milk packaged brand A and brand B showed that there was a significant difference or there was an effect of 5 minutes after drinking liquid cow's milk packaged brand A and brand B on the pH of respondents' saliva. The results of this study are in accordance with research, conducted a study on the value of decreasing salivary pH and plaque pH after consuming 4 different formula milk. The results of this study showed that there were differences in the decrease in the pH value of saliva in each type of milk. [13] Based on the results of this study, they concluded that the difference in the decrease in the pH value of saliva was influenced by the fat content contained in each type of milk. Cow's milk contains 4.3% lactose. Lactose is formed from two carbohydrate components: glucose and galactose. Lactose in cow's milk undergoes slow metabolism by oral bacteria so that the acid formed can be neutralized by the buffering capacity of saliva. [13] This is why there was no significant decrease in salivary pH after consuming cow's milk. Independent Sample T-Test 0 minutes After Drinking Milk Brand A and Brand B showed that there was no significant difference between 0 minutes after drinking brand A liquid cow's milk and 0 minutes after drinking brand B milk on the pH of the respondents' saliva (p=1.00>0.05). This means that brand A and brand B milk do not cause changes in saliva pH. The results of the study are in accordance with the results of research, which state that the decrease in pH can be caused by salivary factors. A decrease in the rate of salivary secretion will cause a decrease in salivary pH. UHT milk is in liquid form and has fewer solids compared to formula milk which can be easily cleaned by saliva, thereby reducing plaque buildup on the tooth surface and minimizing the attachment of bacteria to the tooth surface.[14]

Independent Sample T-Test 5 Minutes After Drinking Milk Brand A and Brand B, the Asymp.Sig (p) value was 0.258> 0.05, meaning that statistically there was no significant difference between 5 minutes after drinking packed cow's milk brand A and brand B (p=0.258>0.05). The results of the study stated that several factors that cause changes in salivary pH are the average salivary flow velocity, microorganisms in the oral cavity, salivary buffer capacity, and frequently consumed foods and beverages. One of the drinks that affect the salivary pH is milk.[15] It is also consistent with research[9], that the decrease in salivary pH that occurs after consuming milk, both whole liquid cow's milk, and powdered cow's milk, might be caused by the carbohydrate content such as lactose, which is fermented by cariogenic bacteria in milk and produces acidic products that can lower the salivary pH.[9]

CONCLUSION

There is no difference in salivary pH before and after drinking packed cow's milk in 0 minutes in children aged 6-12 years, whereas in 5 minutes, the salivary pH before and after drinking packed cow's milk was decreased.

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CONFLICT OF INTEREST

The author declared that there is no conflict of interest

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