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THE EFFECTS OF PROPOLIS MOUTHWASH ON INCREASING THE pH OF SALIVA IN PERSATUAN AMAN BAKTI (PAB) 12 SAMPALI ELEMENTARY SCHOOL

Ika Devi Adiana^{1)*}, Tri Suci Alfarani²⁾

¹Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Sumatera Utara, Medan– Indonesia

²Faculty of Dentistry, Universitas Sumatera Utara, Medan– Indonesia

ABSTRACT

Background: The main problem in dental and oral health among children is dental caries, a complex disease that begins with acid production that destroys dental minerals. When the pH drops to below 5.5, demineralization occurs faster than remineralization, potentially causing cavities. One approach to addressing this issue is by increasing salivary pH. **Purpose:** This study aims to determine the effect of gargling with propolis mouthwash on increasing salivary pH among children aged 7-9 years. **Methods:** This laboratory experimental study used a pretest-posttest controlled-group design. A total of 40 respondents from PAB 12 Sampali Elementary School were selected through purposive sampling. Salivary samples (5 ml) were collected and pH levels measured using a pH meter. **Results:** The Wilcoxon test showed that the average salivary pH before using propolis mouthwash was 6.39, increasing to 7.07 after use. There was a significant effect of propolis mouthwash on salivary pH (p-value = 0.000). **Conclusion:** The findings indicate that propolis mouthwash effectively increases salivary pH in children aged 7-9 years.

Keywords: Age, Gender, Propolis, Salivary pH

***Correspondence:** Ika Devi Adiana; Faculty of Dentistry, Universitas Sumatera Utara, Universitas Sumatera Utara, Jl. Alumni No.2, Padang Bulan, Kota Medan, Indonesia; Email : ika.devi@usu.ac.id

INTRODUCTION

Oral health is an integral part of overall physical health, as it directly affects the body.¹ Damaged and untreated teeth can lead to pain, chewing difficulties, and other health complications.² Consequently, children may avoid chewing on the affected side, prefer softer foods, or even refuse to eat altogether.³

According to the 2018 Basic Health Research (RISKESDAS), 57.6% of the Indonesian population experienced dental and oral health problems, with the highest prevalence (67.3%) among children aged 5-9 years. In North Sumatra, the caries rate reached 43.1%. In 2019, 17,736 elementary school students in Deli Serdang Regency required dental care, but only 4,979 received treatment.⁵ Dental caries is a multifactorial disease involving the host, microorganisms, substrate, and time.⁶ This caries disease is characterized by demineralization, in the hard tissues of the teeth, which starts from a bacterial biofilm (dental plaque) covering the surface of the teeth followed by the destruction of the organic material.⁷

Saliva has many roles in the oral cavity because it always wets the teeth and thus affects the environment in the oral cavity.^{8,9} So far, many salivary parameters have been used to characterize or state a certain disease, both local and systemic.¹⁰ Components contained in saliva also have a role in the development of dental caries. When the pH value of saliva falls <5.5, it means that the oral cavity is very acidic which will facilitate the growth of caries-causing acidogenic bacteria such as *Streptococcus mutans* and *Lactobacillus*.¹¹

Preventing the condition of the oral cavity from becoming too acidic can be achieved by maintaining a normal salivary pH by rinsing with mouthwash containing antimicrobials. The antimicrobial ingredient that has been used in mouthwash is chlorhexidine. Although effective in inhibiting plaque formation, long-term use of chlorhexidine mouthwash can cause disturbances in the balance of oral microflora.¹² An alternative to replace mouthwash is to use natural ingredients that have antibacterial power with fewer side effects.¹³

Propolis, a natural product from bees. It is less cytotoxic on fibroblasts (found in the gums) than to chlorhexidine (also used in caries prevention), which suggests that propolis can be used as a mouthwash ingredient.¹⁴ Propolis also has antibacterial power because it contains flavonoids. Flavonoid compounds function as antibacterials that can disrupt the strength of bacterial cell membranes which causes the growth of acidogenic bacteria such as *Streptococcus mutans* to be inhibited.¹⁵ Therefore, the purpose of this study was to determine the

effect of gargling propolis mouthwash in increasing the pH of the saliva of the oral cavity of children aged 7-9 years at SD PAB 12 Sampali.

METHODS

Material

This was a laboratory experimental study with a pretest-posttest controlled-group design. The study was conducted in May 2022 at PAB 12 Sampali Elementary School. Forty healthy respondents aged 7–9 years were selected using purposive sampling. Ethical approval was obtained from the Ethics Committee of Universitas Sumatera Utara (No. 341/KEPK/USU/2022).

Methods

The research procedure begins with preparing the research tools and materials. The tools needed in this study are saliva pots, mouthwash cups, 15 ml measuring cups, 100 ml plastic beakers, pH meters, stopwatches, and apron clamps. The materials needed are propolis mouthwash (Pieras Propolinse), sterile distilled water, aprons, masks, handsoons, tissues and stationery.

Steps of Procedure

Samples that fit the criteria were asked to fill out an informed consent that had been approved by the parents. Before gargling with the ingredients provided, all samples were asked to standardize by brushing their teeth without using toothpaste. All samples collected saliva by spitting in the saliva pot that had been provided to measure pH before being treated (pre-test). With the spitting method, the sample was instructed to sit in an upright position with the head slightly bowed and instructed to collect saliva at the bottom of the mouth and then spit, and collected into the saliva collection pot that had been held by the sample at the height of the sample's chest and had been labeled with the sample's name for 5 minutes.

RESULTS

The study involved 40 participants, equally divided by gender, 20 respondents (50%) were male and 20 respondents (50%) were female. In terms of age, the highest number of respondents aged 8 and 9 years, each as many as 14 people (35%), while only 12 respondents aged 7 years (30%) (table 1).

Table 1. Characteristics of respondents based on gender and age

Characteristics	Propolis Mouthwash		Distilled water		Total n (%)
	n	%	n	%	
Gender					
Male	10	25	10	25	20 (50)
Female	10	25	10	25	20 (50)
Total	20	50	20	50	40 (100)
Age (years)					
7	6	15	6	15	12 (30)
8	7	17,5	7	17,5	14 (35)
9	7	17,5	7	17,5	14 (35)
Total	20	50	20	50	40 (100)

The results of measuring the average pH of saliva before and after gargling with propolis mouthwash showed an increase in salivary pH. The average salivary pH before gargling with propolis mouthwash was 6.39 ± 0.52 , which increased to 7.07 ± 0.46 after gargling. In contrast, the distilled water group showed a smaller increase (6.75 ± 0.57 to 6.83 ± 0.60). (table 2).

Table 2. Difference in improvement between salivary pH before and after gargling propolis mouthwash and distilled water in children aged 7-9 years at PAB 12 Sampali Elementary School

Group	Observation	Saliva pH (Mean $\pm$ SD)	p-value
Propolis Mouthwash	Before	6,39 $\pm$ 0,52	0,000*
	After	7,07 $\pm$ 0,46	
Distilled water	Before	6,75 $\pm$ 0,57	0,078
	After	6,83 $\pm$ 0,60	

*p<0.05 (Significant)

Based on table 2, it was also obtained through the Wilcoxon statistical test in the propolis mouthwash gargle group, showing a p value of 0.000 (p <0.05). The p value <0.05 indicates that there is a significant difference between the pH of saliva before and after gargling propolis mouthwash, with the average difference in pH between the two being 0.68. The distilled water gargle group showed a value of p=0.078 (p>0.05). The p>0.05 value

indicates that there is no significant difference between the pH of saliva before and after gargling distilled water, with the mean difference in pH between the two being 0.08.

In the group of children before gargling with propolis mouthwash obtained $p=0.732$ ($p>0.05$) and after gargling with $p=0.133$ ($p>0.05$). While in the group of children who gargled with distilled water, the significance value of salivary pH before gargling was $p=0.381$ ($p>0.05$) and after gargling with $p=0.254$ ($p>0.05$). The result showed no significant difference in salivary pH before and after gargling with propolis mouthwash and distilled water between boys and girls at PAB 12 Sampali Elementary School (table 3).

Table 3. Differences in salivary pH before and after gargling mouthwash propolis and distilled water between children's gender at PAB 12 Sampali Elementary School

Group	Observation	Gender	Saliva pH (Mean $\pm$ SD)	p-value
Propolis Mouthwash	Before	Male	6,44 $\pm$ 0,51	0,732
		Female	6,34 $\pm$ 0,55	
	After	Male	7,16 $\pm$ 0,52	0,133
		Female	6,98 $\pm$ 0,39	
Distilled water	Before	Male	6,59 $\pm$ 0,57	0,381
		Female	6,91 $\pm$ 0,54	
	After	Male	6,63 $\pm$ 0,66	0,254
		Female	7,03 $\pm$ 0,50	

* $p<0.05$ (Significant)

Based on table 4, in the group of children before gargling with propolis mouthwash obtained $p=0.659$ ($p>0.05$) and after gargling with $p=0.943$ ($p>0.05$). In the group of children who gargled with distilled water, the significance value of salivary pH before gargling was $p=0.133$ ($p>0.05$) and after gargling with $p=0.402$ ($p>0.05$). From these results it can also be stated that there is no significant difference in salivary pH before and after gargling propolis mouthwash and distilled water between the ages of children at PAB 12 Sampali Elementary School.

Table 4. Differences in salivary pH before and after gargling mouthwash propolis and distilled water between the ages of children at PAB 12 Sampali Elementary School

* $p<0.05$ (Significant)

Group	Observation	Age	Saliva pH (Mean $\pm$ SD)	p-value
Propolis Mouthwash	Before	7 years	6,23 $\pm$ 0,56	0,659
		8 years	6,43 $\pm$ 0,62	
		9 years	6,50 $\pm$ 0,42	
	After	7 years	6,75 $\pm$ 0,49	0,943
		8 years	7,24 $\pm$ 0,34	
		9 years	7,17 $\pm$ 0,45	
Distilled water	Before	7 years	6,70 $\pm$ 0,91	0,133
		8 years	6,80 $\pm$ 0,40	
		9 years	6,74 $\pm$ 0,40	
	After	7 years	6,58 $\pm$ 0,88	0,402
		8 years	7,03 $\pm$ 0,40	
		9 years	6,84 $\pm$ 0,60	

DISCUSSION

The average salivary pH before gargling with propolis mouthwash was 6.39 ± 0.52 , which increased to 7.07 ± 0.46 after gargling. In contrast, the distilled water group showed a smaller increase (6.75 ± 0.57 to 6.83 ± 0.60) at PAB 12 Sampali Elementary School (Table 3). These results are in accordance with research conducted by Sariyem et al, by examining the effect of consuming propolis solution on salivary pH, which showed that there was a significant difference in the treatment group consuming propolis solution with a value of ($p = 0.021$), which means that there is an effect of consuming propolis solution on salivary pH.¹⁶ This is also in line with research that shows the results, that salivary pH after gargling with Melia Propolis produces a significant value ($p = 0.002$), which means that gargling with Melia Propolis can increase salivary pH.¹⁷ The ability of propolis mouthwash to increase salivary pH is obtained through mechanical stimulation, chemical stimulation and antibacterial properties

of mouthwash. Both of these stimuli are able to activate salivary secretory cell receptors in the oral cavity and increase salivary secretion and salivary pH.¹⁸ Both stimuli are able to activate salivary secretory cell receptors in the oral cavity and increase salivary secretion and salivary pH. Increased salivary secretion will increase the bicarbonate content in saliva which acts as a neutralizer of salivary pH, besides that an increase in salivary secretion will increase the salivary flow rate which is directly proportional to the increase in salivary pH.¹⁸ Phytochemical research conducted on propolis, obtained active compounds in propolis, namely flavones and flavonols which are derivatives of flavonoids found to effectively inhibit *glucosyltransferase* (GTF) in *Streptococcus mutans* and are able to cause death to bacterial cells.^{18,19} The reduction of *Streptococcus mutans* bacteria in the oral cavity will cause the acidity of the oral cavity to increase so that the pH becomes alkaline and can even become neutral so that it can prevent oral and dental diseases.²⁰

The results showed that with the Mann-Whitney test conducted, there was no significant difference in the pH of the respondents' saliva before ($p=0.732$) and after ($p=0.133$) gargling with propolis mouthwash between boys and girls at PAB 12 Sampali Elementary School (table 3). This is in line with research conducted by Pallavi et al, where it was found that the mean value of salivary pH for boys was 7.17 and 7.15 for girls with the difference between the two being 0.02 which shows that the mean value is not much different for both.²¹ Several studies conducted did not find significant values to show differences in *stimulated saliva* from both genders even though a slightly lower salivary pH of girls than boys was observed.²² The slightly lower salivary pH of girls compared to boys is due to the amount of IgA in girls more than boys. The high amount of IgA in saliva causes the ability to reduce antigenic load to be high.²³

The results showed that there was no significant difference in the salivary pH of respondents before ($p=0.659$) and after ($p=0.943$) gargling with propolis mouthwash between the ages of 7, 8, and 9 years at SD PAB 12 Sampali (table 4). This is in line with research conducted by Pallavi et al, where the significance value of salivary pH for ages 7-10 years was obtained ($p>0.005$), which means that there is no significant correlation between the pH of children's saliva and this age range. Histologically, with increasing age, the parenchymal cells in the salivary glandula will continue to be replaced by adipose cells and fibrovascular tissue and the volume of the acini decreases so that the salivary rate also decreases which correlates with salivary pH. The assumption that the age range of children 7-9 years old is not too far away and still young is the reason for the absence of such a striking difference in the results of the study.²¹

Based on the results of the study, it was concluded that the mean pH value of the respondents' saliva before gargling was lower than after gargling propolis mouthwash, namely 6.39 compared to 7.07. The results showed that there was a significant difference in the increase in salivary pH before and after gargling propolis mouthwash in children aged 7-9 years at PAB 12 Sampali Elementary School with a significance value ($p=0.000$). The results showed no significant difference in salivary pH before ($p=0.732$) and after ($p=0.133$) gargling propolis mouthwash between boys and girls in children aged 7-9 years at PAB 12 Sampali Elementary School. The results showed no significant difference in salivary pH before ($p=0.732$) and after ($p=0.133$) gargling propolis mouthwash between the ages of 7,8 and 9 years old in children aged 7-9 years at PAB 12 Sampali Elementary School.

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