

The Effect of Arabica Coffee (*Coffea Arabica L.*) Consumption on Salivary pH Among High School Students in Jakarta

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ABSTRACT

Backgrounds: The habit of drinking coffee has become a necessity and routine for all levels of society, both men and women, young people, teenagers, and the elderly. Coffee is one of the main export commodities in Indonesia. Coffee is a popular drink and is loved by almost the majority of the world's population because coffee not only provides a distinctive aroma and taste but also provides many health benefits. Arabica coffee is one type of coffee that is widely consumed by the public. Arabica coffee has a more acidic pH compared to other types of coffee. Consuming coffee can affect changes in the acidity of a person's salivary pH. The acidity (pH) of saliva plays an important role in the occurrence of dental caries and various other oral diseases. Streptococcus mutans and other acidogenic bacteria thrive when the salivary pH is low (4.5-5.5). Arabica coffee has the main content, namely carbohydrates and acids that are thought to cause a decrease in the acidity (pH) of saliva.

Objectives: This study aims to determine the effect of consuming Arabica coffee (*Coffea arabica L.*) on the degree of acidity (pH) of saliva.

Methods: The data collection method in this study used a clinical experimental method with a one group pre-test post-test design. The population in this study were high school students in Jakarta aged 18-19 years. The number of samples in this study was 30 subjects who met the inclusion criteria. The results of the study were analyzed using the SPSS (Statistical Package for the Social Science) program with the Shapiro Wilk Test for normality because the data group was small, less than 50 (n<50). The data or results of this study were non-normally distributed (p≤0.05). The next step was to conduct a non-parametric Wilcoxon statistical test to determine whether there was a change in salivary pH before and after consuming Arabica coffee (*Coffea arabica L.*).

Results: The results of the statistical test showed that there was no significant difference in salivary pH before and after consuming Arabica coffee.

Conclusion: Long-term consumption of Arabica coffee (*Coffea arabica L.*) does not significantly affect salivary pH balance. However, it is recommended that individuals limit their coffee intake to maintain optimal oral health.

KEYWORDS: Coffea arabica, saliva, acidity (pH) of saliva, dietary habits.

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INTRODUCTION

The culture of coffee consumption today is not just a matter of fulfilling a need, but has become part of a lifestyle that also considers a person's prestige or status. The influence of urban lifestyles is marked by the proliferation of cafes and coffee shops, which has increased the number of coffee consumers.^{1,2} The habit of drinking coffee has become a

necessity and routine for all segments of society, including men and women, young people, teenagers, and the elderly.^{3,4} Coffee is one of Indonesia's main export commodities. In the past five years, Indonesia has successfully ranked fourth as the largest coffee exporter in the world, right after Brazil, Colombia, and Vietnam.^{5,6} Coffee is a popular drink enjoyed by most people around the world because it not only has a

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distinctive aroma and taste but also provides many health benefits.⁷

Saliva (mouth water/saliva) found in the oral cavity has various functions, including lubricating the oral cavity, cleaning, aiding digestion, and buffering capacity to neutralize acids or bases.⁸ The acidity level (pH) of saliva is a measure that determines the degree of acidity or alkalinity of saliva, measured on a scale of 0 to 14. The average acidity level (pH) of saliva under normal conditions ranges from pH 6.7.^{9,10} The acidity level (pH) of saliva is one of the important factors that play a role in dental caries, periodontal disorders, and other diseases in the oral cavity.^{11,12} The acidity level (pH) of saliva can cause changes due to the habit of consuming coffee.¹³ This is because coffee contains several acidic substances. The acidity level (pH) of saliva is one of the important factors that play a role in preventing dental caries (cavities), enamel demineralization (loss of enamel minerals), and other diseases in the oral cavity.^{3,14,15}

Oral health is closely related to overall health. A person may experience various problems and discomfort due to poor oral hygiene. Therefore, a good diet is very important for maintaining oral health. Diet can also affect salivary pH.^{9,16}

Arabica coffee is one of the most widely consumed types of coffee. Arabica coffee has a more acidic pH than other types of coffee.^{17,18,19} Based on this, research was conducted to determine the effect of consuming arabica coffee (*Coffea arabica* L.) on the acidity (pH) of saliva. Arabica coffee (*Coffea arabica* L.) is the coffee with the best flavour compared to other types of coffee.²⁰ Arabica coffee (*Coffea arabica* L.) is a plant that has a large population in Indonesia and is one of the world's commodities. Arabica

coffee has anti-inflammatory, antihyperglycemic, anticellulite, hyperuricemia, antimicrobial, and antioxidant activities. This indicates that arabica coffee (*Coffea arabica* L.) has active ingredients or secondary metabolites such as caffeine and chlorogenic acid that provide these activities.¹⁸

Based on the above issues, an alternative solution is needed so that people can continue to enjoy coffee without worrying about the negative effects it causes. Therefore, education is needed for the public, carried out by medical personnel/health services to provide explanations about the effects of coffee consumption on the pH of saliva in the oral cavity. This study focuses on the effect of arabica coffee (*Coffea arabica* L.) on the acidity level (pH) of saliva. In addition, it is hoped that people will be able to continue enjoying coffee while minimizing the side effects on the oral cavity.

MATERIALS AND METHODS

The type of research conducted was clinical experimental with a one group pre-test post-test design. The data obtained were statistically evaluated using the SPSS (Statistical Package for the Social Sciences) program by performing a normality test with the Shapiro-Wilk Test because the data group was small, namely $n < 50$. The data or results of this study were found to be non-normally distributed ($p \leq 0.05$). The next step was to perform a Wilcoxon nonparametric statistical test to determine whether there was a change in salivary pH before and after consuming arabica coffee (*Coffea arabica* L.).

RESULTS AND DISCUSSION

The research results can be seen in the following table:

Table 1. Frequency distribution based on gender (n=30)

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Male	13	43.3	43.3	43.3
	Female	17	56.7	56.7	100.0
	Total	30	100.0	100.0	

Table 2. The average salivary pH before and after (n=30)

	Mean	Std. Deviation
Salivary pH (before)	7.54	0.33753
Salivary pH (after)	7.72	0.30742

Table 3. Data Normality Test

Tests of Normality						
Kolmogorov-Smirnov ^a				Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Salivary pH	.149	30	.087	.924	30	.034

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(before)						
Salivary pH	.112	30	.200*	.966	30	.445
(after)						

* This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The subject group in this study consisted of 30 participants, which is less than 50 ($n < 50$). Therefore, data normality was tested using the Shapiro-Wilk Test. The data in this study were found to be non-normally distributed ($p \leq 0.05$). The data normality test for this study can be seen in table 3.

Table 4. Wilcoxon test

<i>Related-Samples Wilcoxon Signed Rank Test</i>	
Total N	30
Test Statistic	300.500
Standard Error	46.226
Standardized Test Statistic	1.796
Asymptotic Sig. (2-sided test)	.073

The next step in this study was to conduct a Wilcoxon nonparametric statistical test. This test was conducted to determine whether there was a change in salivary pH before and after consuming arabica coffee (*Coffea arabica* L.). The results of the test can be seen in table 4.

This study was intended to determine the effect of arabica coffee (*Coffea arabica* L.) on salivary pH in maintaining dental and oral health. This study was conducted on male and female subjects at SMAN 108 Jakarta. The arabica coffee used was registered with the Indonesian Food and Drug Administration (BPOM) and is commonly consumed by the public. The pH measurements were taken before and after the subjects consumed arabica coffee that had been brewed according to the processing instructions. The results of this study showed a decrease and increase in salivary pH after exposure to arabica coffee, both in the male and female groups. This study used saliva collected by the spitting method to provide an overview of the condition of human saliva in general.

An important variable that plays a role in preventing enamel demineralization and dental caries is the acidity (pH) of saliva. Consuming cariogenic foods such as sucrose can cause changes in salivary pH, as can drinking coffee, because coffee contains sucrose.³ Coffee consumption is currently quite prevalent in urban communities because there are so many cafes that serve coffee. Coffee contains various acidic compounds that can cause a decrease in salivary pH.²⁵

The frequency distribution based on gender in this study can be seen in table 1. It appears that there were more female subjects in this study than male subjects. This was due to the inclusion criteria, which included subjects who did not smoke. It was very difficult to find male research subjects who did not smoke.

Table 2 shows that the average pH of saliva before

treatment was 7.54, while after treatment it was 7.72. Although the pH of saliva after treatment appears to be higher than before treatment, there is no significant difference in the results of the study.

The data normality test table can be seen in table 3. It can be seen that the p-value pH before is 0.034. Therefore, the data normality test in the study shows that the data is not normally distributed because the p-value pH before ($p \leq 0.05$).

Based on the previous test, which showed that the data was not normally distributed, the Wilcoxon test was performed. The results of the Wilcoxon test can be seen in table 4. This test shows that there is no difference in salivary pH before and after treatment with coffee consumption. The conclusion from these test results is that there is no difference between salivary pH before and after coffee consumption.

The results obtained in this completed study appear to be in line with the research by M. Daglia et al. In that study, it was found that coffee solution has an antibacterial effect, making it effective as an anti-plaque agent and preventing a decrease in salivary pH. This differs from and is not in line with the results of the study by Luciane Dias et al., which showed that the caffeine contained in coffee only has antibacterial properties. It is said that coffee does not have antiadhesive properties, so microorganisms in the oral cavity, such as *Streptococcus mutans*, will form dental plaque, followed by a decrease in salivary pH.²⁵

This study also does not correspond with research conducted in 2021 by Zaza Paroza et al. In that study, there was a decrease in salivary pH in the subjects. Coffee consumption is said to cause a decrease in salivary pH because coffee contains carbohydrates, namely sucrose and monosaccharides.³

An individual's eating and drinking patterns greatly affect salivary pH. Fifteen minutes after eating or drinking,

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salivary pH is acidic but will return to normal within 30–60 minutes. The buffer system in saliva prevents pH fluctuations caused by food and drink consumption. The oral cavity has two mechanisms for maintaining salivary pH. First, saliva flow removes carbohydrates metabolized by bacteria, thereby reducing acid production. Second, the acidic nature of food and beverages and bacterial activity are neutralized by the buffer system.⁹ This resulted in the studies conducted showing no decrease in salivary pH and indicating no significant difference through the Wilcoxon test.

Although in this study more subjects experienced an increase in salivary pH, there were some subjects who experienced a decrease in salivary pH. Some subjects who consumed coffee experienced a decrease in salivary pH, but did not reach critical pH levels, so it can be said to be safe. This is because the subjects were not classified as coffee addicts. The research subjects only consumed coffee occasionally. The majority of subjects had alkaline pH before treatment. This alkaline pH category may be due to the fact that many subjects consumed foods rich in fibres and protein rather than carbohydrates.^{10,12,14} Fifteen minutes after eating can also cause a decrease in salivary pH to below 6.1.²⁴ However, in this study, subjects were not allowed to eat before treatment. Therefore, none of the subjects, who were students at SMAN 108 Jakarta at the time of examination, had low (critical) pH levels and even tended to have alkaline pH levels. An increase in salivary pH (alkaline) can cause the formation of dental plaque. Salivary pH and buffer capacity are high immediately after waking (resting state), then quickly decrease, and are elevated again about fifteen minutes after eating (mechanical stimulation). However, they typically decrease again within 30–60 minutes, rise slightly until evening, and then decrease.¹² This study was conducted in the afternoon after school, which is one of the reasons why the subjects' salivary pH before the treatment was not in a critical condition. Additionally, the subjects were not in a postprandial state, so their salivary pH was not acidic.

CONCLUSION

Based on the results and discussion of the above study, the conclusions are as follows:

1. The effect of arabica coffee (*Coffea arabica* L.) consumption on the acidity (pH) of saliva in subjects showed that there was no significant difference between the pH of saliva before and after consuming arabica coffee.
2. Long-term consumption of arabica coffee (*Coffea arabica* L.) does not have a significant effect on the pH balance of saliva. This means that there is no significant potential risk to dental and oral health.
3. Ways for people to consume coffee without causing adverse effects on dental and oral health include using a straw when drinking coffee and rinsing with water after drinking coffee.

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