# Effect of Robusta Coffee (Coffea Canephora) on the Degree of Acidity (pH)

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# Effect of Robusta Coffee (Coffea Canephora) on the Degree of Acidity (pH) of Saliva

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| ABSTRACT | Published Online: 10 May, 2023 |
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**Background:** saliva is a complex fluid produced by the salivary glands and plays an important role in maintaining oral health. Saliva consists of 98% - 99% water, about 2% is composed of organic & inorganic components, electrolytes, and various enzymes. Robusta coffee (Coffea canephora) has the main content of caffeine, carbohydrates, protein and free amino acids, and chlorogenic acid. The content in the coffee can cause changes in the level of saliva acidity (pH).

**Purpose:** to better understand the effects of robusta coffee (Coffea canephora) against level of saliva acidity (pH).

**Method:** based on the exclusion and inclusion criteria, a total of fifteen (15) journals were analyzed from the Google Scholar, Science Direct, PubMed's and NCBI. The journals that analyzed are regarding an article that discusses the effect of coffee on salivary pH.

**Conclusion:** this review reveals that robusta coffee (Coffea canephora) causes a decrease in the acidity (pH) of saliva. This happens due to the higher the concentration of the coffee, the pH of the coffee becomes more acidic, but there are several studies reports that low concentrations of robusta coffee (Coffea canephora) do not cause a decrease in salivary pH.

**KEYWORDS:**
Salivary pH, robusta coffee, saliva.

## INTRODUCTION

Oral health is a reflection of an overall healthy body and affects a person's quality of life. Individual dietary patterns are important things that need to be considered to maintain dental and oral health. Excessive intake of certain substances can damage organs, including the oral cavity as the first access point when individuals are eating and drinking activities. Dietary patterns can affect the degree of acidity (pH) of saliva and play a direct role in the formation of dental caries.[1,2]

Saliva is an exocrine gland that plays a very important role in the oral environment and consists of almost 99% water and the remaining 1% is a combination of molecules such as calcium, magnesium, potassium, chloride, bicarbonate and phosphate. Saliva also contains various body defense substances.[3,4] The functions of saliva include lubrication of the oral cavity, cleansing substances, aiding digestion and buffering capacity to neutralize acids or bases. Flow rate, acidity (pH), and characteristics of saliva and oral hygiene are interrelated with the risk of oral disease.[3,5]

Potential of hydrogen (pH) is a measure that determines the acid or alkaline degree of a solution, pH is measured on a scale of 0 to 14. The degree of acidity (pH) of saliva under normal circumstances ranges from 5.6 to 7.0 with an average pH of 6.7. The optimum salivary acidity for bacterial growth and development is 6.5-7.5 and if the oral cavity has a low pH between 4.5-5.5 it will facilitate the growth of acidogenic bacteria such as Streptococcus mutans and Lactobacillus.[6,7]

Robusta coffee (Coffea canephora) is one of the most widely cultivated coffee types in Indonesia. Robusta coffee has a higher planting area and resistance to the environment and pests compared to Arabica coffee. Robusta coffee is a second-class coffee after Arabica coffee because the taste of Robusta coffee is bitter, less acidic and has a higher caffeine content compared to Arabica coffee.[8] Coffee has a certain taste not only based on its type, but also based on the growing location, climate, harvest and post-harvest

processes, roasting process, grinding and brewing methods that determine the taste of the resulting coffee.[9]

Coffee also contains many compounds that are beneficial to the body, one of which is caffeine, which is very useful in inhibiting the growth of cancer cells. Antioxidants contained in coffee are more than fruits and vegetables. Some antioxidant compounds found in coffee include flavonoids, polyphenols, coumarins, proanthocyanidins, chlorogenic acid, trigonellins and tocopherols.[10]

Coffee that is drunk regularly can cause a decrease in the degree of acidity (pH) of saliva because coffee contains acidic substances. The degree of acidity (pH) of saliva is one of the main factors that play a role in preventing dental caries, tooth demineralization, and other diseases in the oral cavity.[11] Research conducted by Paroza et al. in 2021 found that robusta coffee solution can affect changes in salivary pH in healthy subjects. This is indicated by the results of the average value of measuring the pH of saliva that has been treated with robusta coffee solution has decreased pH.[12] A decreased salivary acidity (pH) indicates a high risk of dental caries.[13] Research conducted by Masoumi et al. in 2016 found that the coffee solution did not cause a decrease in the pH of the saliva of healthy subjects.[14] These studies show differences in the results of salivary pH after being treated with robusta coffee.

Based on this, it can be seen that robusta coffee has an effect on salivary pH. It is hoped that by knowing these effects, people can rethink the risks and consequences of robusta coffee consumption.

**METHODS**

This literature review was made by analyzing and evaluating scientific knowledge from various references. The references used are sourced from articles, journals, and websites accessed through databases: Google Scholar, Research Gate, PubMed, and NCBI. The search strategy was based on the keywords salivary pH, robusta coffee, and saliva or Salivary pH, robusta coffee, and saliva. The types of journals used in writing are research journals and literature reviews published from 2017-2020. The initial selection of research journals and literature reviews was carried out based on the title and abstract related to robusta coffee, then the text was read in its entirety. Information related to the evaluated variables was then collected based on: author's name, year, type of article, and results with the theme of discussion regarding the effect of robusta coffee on salivary pH.

**RESULTS**

The results found in the searched database are shown in the flowchart provided in figure 1. Six hundred and five references were found in the Google Scholar database, 100 references were found in the Research Gate database, 33 references were found in the PubMed database, and 19 references were found in the NCBI database. After conducting an analysis based on the inclusion criteria and

reading the available abstracts, the titles and relevance of the abstracts were filtered so that 30 articles were selected. Articles published under 2010 are not included as references because the provisions of this writing are to use journals from the last 10 years. Total articles read as a whole were 20. Articles discussing the effect of coffee on salivary pH in general were 15. Articles regarding articles discussing the effect of robusta coffee on lowering salivary pH by 6, articles discussing the effect of robusta coffee on not lowering salivary pH by 1 and 1 article discussing the effect of Robusta coffee concentration on salivary pH. The articles obtained were then analyzed to understand and draw conclusions from the various research articles. It was found that there were articles discussing the effects of Robusta coffee on the degree of acidity (pH) of saliva, so that the total number of articles relevant to the theme of the literature review was 6. The referenced journals were published between 2013 and 2021.

The general summary of the results of the analysis of the findings of important data from various research articles stated that consuming Robusta coffee can affect salivary pH. This influence is still the pros and cons because of differences in the results of research that has been conducted by experts. Some research experts argue that consumption of Robusta coffee can cause a decrease in salivary pH. Other researchers also stated that Robusta coffee consumption did not cause a significant change in salivary pH. This is a concern for health practitioners, in order to provide knowledge to the public regarding the various opinions of these experts. The main findings related to the effect of robusta coffee on the degree of acidity (pH) of saliva can be seen in table 1.
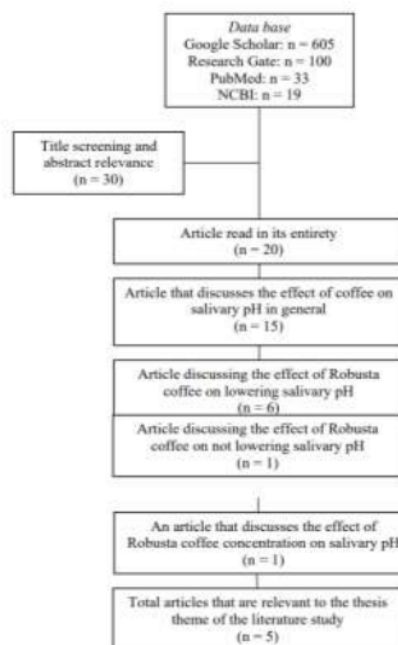


**Figure 1. Publication flowcharts of all databases**

**Table 1. Relevant Article Descriptions Based on Author, Year, Type of Article, and Results**

| Author | Year | Type of Article | Result |
|---|---|---|---|
| Paroza Z, Deynilisa S | 2021 | Research Report | The average salivary pH before consuming Robusta coffee was 7.020 and after consuming Robusta coffee was 5.537. Paired T-test obtained results of p = 0.000 (p <0.05) indicating a decrease in salivary pH after consuming Robusta coffee. |
| Soraya C, Sunnati, Munawar S. | 2013 | Research Report | Based on the measurement results, the pH value of Robusta coffee before being exposed to artificial saliva was 5.54 (pH of artificial saliva = 6.8). The results of the analysis showed that the average pH value of saliva after being exposed to Robusta coffee decreased in pH. In measuring the pH of Robusta coffee exposed to artificial saliva, the average pH value was 6.00. Based on the results of the Anova analysis, Robusta coffee with artificial saliva showed a significant relationship (p <0.05), so it can be concluded that there is an effect of Robusta coffee on changes in salivary pH. |
| Imran H, Nurdin, Nasri | 2016 | Research Report | The results showed that there was an effect of coffee consumption on a decrease in salivary pH where the mean was 5.7 in subjects who regularly consumed coffee and were not coffee drinkers with a mean of 6.5 which was proven by a significant effect. The results of statistical analysis of data (Independent T-Test) obtained p = 0.040. The conclusion from the research results states that coffee consumption significantly affects the decrease in salivary pH in the adult age group. |
| Sa'diah K, Hayati M | 2018 | Research Report | Based on the research conducted, the results showed that the average salivary pH of the coffee addict group was lower than that of the control group, with a mean coffee addict pH of 5.30 (min 5.01-max 5.88) and the control group 6.29 (min 5 .75-max 6.92). This means that the pH of the control group is better than the pH of the coffee addict group. |
| Masoumi S, Setoudehmaram S, Golkasri A, Tavana Z. | 2017 | Research Report | The research conducted showed that the initial salivary pH measurement for healthy subjects was 6.86 and for subjects with periodontitis it was 6.87. The mean value of salivary pH after rinsing with coffee solution in healthy subjects was 6.86 and in subjects with periodontitis it was 6.86. Based on these results, coffee did not cause a significant change in pH in healthy subjects or subjects with periodontitis. |

## DISCUSSION

Saliva has a major role in maintaining oral health and hygiene and protecting teeth from caries. [15] Saliva in the oral cavity is one of the body's defense mechanisms. [16] The degree of acidity (pH) of saliva is a measure that describes the degree of acidity of saliva on a scale of 0 to 14 and is influenced by changes caused by day and night rhythms, diet, speed salivary flow and salivary buffer capacity. [17] A decrease in salivary pH greatly affects the stability of saliva in protecting the oral mucosa so that the attachment of bacteria to the oral mucosa will easily occur. The attachment of bacteria to the mucosa will facilitate the occurrence of infections which can cause various diseases in the oral cavity.[16]

Diet greatly affects the salivary pH, 15 minutes after eating, the salivary pH is acidic but will return to normal within 30 – 60 minutes. [18] The buffer system in saliva functions to prevent the rise and fall of pH caused by food and drink. [17] The oral cavity has two mechanisms for maintaining

salivary pH. First, salivary flow removes carbohydrates that are metabolized by bacteria thereby reducing acid production. Second, the acidity of food and drink and bacterial activity are neutralized by the buffer system.[19]

The habit of consuming coffee has become a necessity and routine for both men and women, young people, teenagers and the elderly. The habit of consuming coffee can cause changes in salivary pH because coffee contains acids. Robusta coffee generally has a low pH (average pH value 5.25-5.40) however, does not cause a critical change in salivary pH.[2]

Research conducted by Paroza et al. in 2021 showed that the average salivary pH before consuming robusta coffee was 7.020 and after consuming robusta coffee was 5.537. The average salivary pH before consuming Arabica coffee was 6.887 and after consuming Arabica coffee was 4.867. The decrease in salivary pH in the group that consumed Arabica coffee was greater than that of Robusta coffee. This is because the two coffees contain acids, but Arabica coffee is generally more acidic than Robusta coffee. Coffee consumption can cause a decrease in salivary pH because coffee contains high concentrations of simple carbohydrates, namely sucrose and monosaccharides.[2]

Coffee contains a high concentration of carbohydrates, fermenting carbohydrates will produce acids which can cause a decrease in salivary pH. Changes in salivary pH are influenced by the type of food consumed, stimulation of salivary secretion, salivary flow rate, time, oral microorganisms, and salivary buffer capacity. The degree of salivary acidity decreases due to the production of acid from bacteria after consuming carbohydrates. Coffee can be classified as a drink that can increase the risk of dental caries if consumed continuously for more than 30-60 minutes. [20]

Research conducted by Imran et al. in 2016, showed the effect of consuming robusta coffee on lowering salivary pH, the average salivary pH was 5.7 in subjects who regularly consumed coffee and 6.5 in subjects who did not consume coffee. The results of statistical analysis of data (Independent T-Test) obtained p = 0.040. The conclusion from the results of this study is that the consumption of Robusta coffee significantly affects the decrease in salivary pH in the adult age group.[21]

Similar research was conducted by Sa'diah et al. In 2018 the results showed that the average salivary pH of the coffee holic group was lower than the control group, with the average coffee holic pH being 5.30 (min 5.01-max 5.88) and the control group 6.29 (min 5.75 - max 6.92). This study showed that the pH of the control group was better than the pH of the coffee holic group. The degree of salivary acidity in coffee holics is lower than those who do not, and the decrease in salivary pH occurs within 5-7 minutes after consuming coffee because the main content of robusta coffee consists of sucrose which is an active compound to colonize with Streptococcus mutans resulting in a decrease in salivary

pH. The content of other ingredients in the coffee solution consists of chlorogenic acid and nicotinic acid so that consuming coffee has a direct effect on reducing the salivary pH to become acidic. [22]

Research conducted by Masoumi et al. in 2016, showed the results of the initial healthy subject's average salivary pH of 6.86. The mean value of salivary pH after rinsing Robusta coffee solution in healthy subjects was 6.86. Based on the results of this study, it appears that robusta coffee does not cause a significant change in the salivary pH of healthy subjects. [14]

The difference in the results of the studies conducted was caused by various factors, including different concentrations of coffee. Higher coffee concentrations result in an increasingly acidic coffee pH, because the main ingredients of coffee consist of carbohydrates, sucrose, free amino acids, lipids, organic acids, chlorogenic acid, and caffeine which can lower pH. [14]

Coffee concentration factors, different types of treatment and methods can cause different changes in the degree of salivary acidity. The way a person consumes acidic foods and soft drinks has been known to influence differences in acid content and the pattern of damage that occurs. [13]

There are six drinking methods according to Soraya, namely holding the drink in the mouth, sucking for a short time with a glass, sucking for a long time with a glass, drinking with a baby bottle and drinking using a straw. The results showed that holding the drink in the mouth before swallowing caused the greatest decrease in pH, followed by prolonged sucking with the glass, whereas direct gulping showed only a small decrease in pH. [13]

Based on studies conducted by experts, robusta coffee can cause a decrease in salivary pH due to coffee contents such as caffeine, carbohydrates, sucrose, organic acids and chlorogenic acid which can lower salivary pH. The concentration of coffee and the method of consuming coffee also affect the acidity that will be produced, the higher the coffee concentration, the lower the salivary pH will be, and vice versa. Consuming robusta coffee (Coffea canephora) at a concentration determined by the manufacturer can generally lower salivary pH significantly.[13]

## CONCLUSIONS AND SUGGESTIONS

Robusta coffee (Coffea canephora) has the main content of caffeine, carbohydrates, proteins and free amino acids, and chlorogenic acid. The content in coffee can reduce the degree of acidity (pH) of saliva. Based on several research results conducted from 2013 to 2022, it can be concluded that robusta coffee (Coffea canephora) causes a decrease in the degree of acidity (pH) of saliva. This happens because the higher the concentration of coffee, the more acidic the pH of the coffee, but there are some studies that report that robusta coffee (Coffea canephora) with low concentrations does not cause a decrease in salivary pH.

It is hoped that other studies will be carried out so that more information can be obtained about robusta coffee (Coffea canephora) that is safe for consumption, taking into account the concentration of coffee, time and method of consumption so that it can still be consumed without causing a decrease in salivary pH.

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# Effect of Robusta Coffee (Coffea Canephora) on the Degree of Acidity (pH)

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