

The Effect of Secang Drink Consumption in Increasing Salivary Flow Rate and Salivary Ph in Smokers and Related to Body Mass Index

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Abstract

Secang (*Caesalpinia sappan* L.) is a plant of Leguminosae family that has long been used in health field. It contains an active substance, namely brazilin, a flavonoid compound. This flavonoid compound has bitter taste. This bitter taste is believed has the ability to increase salivary secretion, thereby it will increase salivary flow rate and salivary pH. Long-term smoking causes decrease in salivary secretion. The purpose of this study is to compare salivary flow rate and salivary pH prior to and after consumption of secang drink in smokers, related to body mass index.

This research was a quasi-experimental study, conducted on 30 male smokers and also students from Padjadjaran University who had been smoking for two years or more. Salivary flow rate and salivary pH were measured before and after consuming secang drink. Other data taken were physical examinations such as body weight and height. The data were analyzed using a paired t-test with $\alpha = 0.05$. The results displayed that the average values of salivary flow rate ratio prior to and after consuming secang drink were 0.49ml/minute and 0.62 ml/minute respectively. The average values of salivary pH ratio prior to and after consuming secang drink were 7.11 and 7.33 respectively.

The results of paired t-test showed that there was a significant increase after consuming secang drink with p-value of 0.00. The BMI measurements showed results, 23 students (76.66%) had normal BMI, 2 (6.66%) students were underweight and 5(16.66%) students were overweight. The highest BMI was 37.5, had salivary flow rate 0.76, and salivary pH 7,3, while the lowest BMI was 16.36, had salivary flow rate 0.66, and pH 7,1.

The conclusion of this study, consumption of secang drink does increase the salivary flow rate and salivary pH in smokers, related to the body mass index.

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Introduction

Smoking is a behavior that is associated with increased risks of diseases worldwide. The consumption of tobacco has reached the proportions of global epidemic where over 15 billion cigarettes are smoked worldwide and are expected to increase due to the expansion of the world's population.¹ According to World Health Organization, Indonesia is the third country with the largest number of smokers in the world after China and India.² Based on Basic Health survey

in 2013, the prevalence of smoking among Indonesian people aged > 15 years increased from 34.2% in year 2007 to 36.3% in year 2013 where 64.9% among them were males and 35.1% were females.³

Smoking causes health problems.⁴ When a person smokes a cigarette, the saliva is the body's first biological fluid that is exposed to the cigarette smoke.⁵ Cigarette smoke contains nicotine, tar, carbon monoxide gas, tobacco-specific nitrosamine and ammonia. Smoking in the long-term can reduce salivary flow rate and salivary pH, because a decrease in bicarbonate causes a decrease in salivary pH.⁶

Saliva has many functions to maintain oral and dental health.⁷ Salivary flow rate is different for each individual. The average salivary flow rate is 0.3 ml / minute and if stimulated, the flow will increase to 1.5-2.0 ml / minute.⁷

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Reduced salivary flow rate can increase the risk of caries and periodontal disease. Salivary pH plays an important role in the proliferation of bacteria in the oral cavity. The number of acidophilic bacteria increases at a very low salivary pH levels.⁸ There are many ways to increase the salivary flow rate and salivary pH, one of them is by consuming secang drink. Secang (*Caesalpinia sappan* Linn) is a plant that has long been used as a traditional medicine.^{9,11} The active substance in secang is brazilin or brazilein that has bitter taste. When a person drinks something bitter, the saliva will flow more to remove the bitterness. It means that by drinking Secang, the secretion of the saliva will be increased.⁹ The purpose of this study is to compare salivary flow rate and salivary pH prior to and after consumption secang drink in smokers related to their body mass index.

Materials and methods

This research was a quasi-experiment, conducted on 30 male smokers. They were also students from Universitas Padjadjaran who had been smoking for two years or more. Their age ranged between 18 to 23 years old. Another data collected were body weight and height. The salivary flow rate computation was achieved by measuring the volume of saliva collected, divided by time. The salivary pH measurement was taken from the collected saliva using a digital pH meter to record the salivary pH ratio prior to and after secang drink consumption.¹²

Secang drinks were made from secang powder packed in sachets (15gram) with 175 ml hot water (100°C). First, the secang sachet was soaked in the hot water for 2 minutes, then the sachet was removed and the water would turn red. The water was then left to cool itself. Measurements taken from the subjects before consuming the secang drinks were salivary volume and salivary pH. The procedure selected for this study was spitting method for collecting unstimulated saliva. The subjects were asked to sit still while letting their saliva accumulated under their tongue for 1 minute then they were directed to spit out the saliva to a measuring glass, and repeated it for 10 minutes. Salivary flow rate was calculated for 10 minutes. Salivary pH was also checked by using pH meter. Afterwards, the subjects were ordered to drink 100 ml secang drink, and waited 10 minutes for

the second measurements. After the 10 minutes were over, the salivary volume and the salivary pH of the subjects were measured again. The data obtained were analyzed using a paired t-test with $\alpha = 0.05$.

Results

The total 30 respondents who participated in this study were males, with age ranging from 18 to 23 years old. The lowest and the highest salivary flow rate before consuming secang drinks were 0.1 and 1.15 ml/minute respectively. While the lowest and the highest salivary flow rate after consuming secang drinks were 0.22 and 1.25 ml/minute respectively. Table 1 shows the average and paired t-test result of salivary flow rate before and after consuming secang drinks. The average salivary flow rate before and after consuming secang were 0.49(SD: 0.2) and 0.62 (SD: 0.3) ml/ minute respectively. Furthermore, the lowest and highest salivary pH before consuming secang drink were 6.7 and 8 respectively. The lowest and the highest salivary pH after consuming secang drink were 6.9 and 8.2 respectively. Table 2 shows the average and paired t-test result of salivary pH before and after consuming secang drink. The average pH before and after consuming secang were 7.11(SD: 0.2) and 7.33(SD:0.2) respectively. The paired t-test results showed a significant increase of salivary flow rate and salivary pH after consuming secang drinks with a p-value of 0.00 less than 0.05, and the results are presented in Table 1 and 2. This study categorized the BMI into 3 groups: underweight, normal and overweight. Table 3 shows the nutritional status of the respondents in the study. In general, 23(76.66%) have normal BMI, 2 (6.66%) respondents are underweight and 5(16.66%) respondents are overweight.

Group	Average (ml/minute)	Difference (ml/minute)	N	t-test	t-table	p-value	Sig.
Before consuming secang drinks	0.49	0.13	30	-6.755	2.756	0.000	.000
After consuming secang drinks	0.62						

Table 1. Average and paired t-test results of salivary flow rate before and after consuming secang drink.

Group	Average	Difference	N	t-test	t-table	p-value	Sig.
Before consuming secang drinks	7.11	0.22	30	12.23	1.699	0.000	.000
After consuming secang drinks	7.33						

Table 2. Average and paired t-test results of salivary pH before and after consuming secang drink.

Category	Frequency	Percentage (%)
underweight	2	6.66
Normal	23	76.66
overweight	5	16.66
Total	30	100

Table 3. Characteristics of nutritional status.

Discussion

Reduced salivary flow rate is found in smokers.¹³ However, smokers still try to increase their salivary flow rate by devouring food / drinks that contain antioxidants. Brazilin is a safe natural compound having the potential to be developed as a medicinal compound with application in food, beverage, cosmetics and pharmaceutical industries to screen its clinical use in modern medicine.¹⁴

According to a study in the central laboratory of Padjadjaran University, secang drinks contain brazilein. This brazilein was tested using phytochemical test, and it was found that brazilein was an oxidized brazilin. The test results also showed that secang wood shavings had the highest content of Brazilin.¹⁵ This brazilin with its bitter tastes had the capacity to increase the salivary flow rate and the salivary pH. Another beneficial effect of brazilin is that it can relax and freshen the body.

Increased salivary flow rates can be caused by chemical stimuli from flavors that originate from food / drink.¹⁶ In this study the chemical stimulus come from bitter taste of the secang drink. Bitter taste from the secang drink will be received by the taste bud on the tongue. This will create the sensation of taste and this will affect the salivary flow rate.

The secang solution touches the taste buds then comes into contact with the tip of the apical taste bud, thus producing an impulse to be delivered through the afferent vasa to the

salivary center in the medulla oblongata.¹⁷ The impulse will be transmitted through the parasympathetic nerve to the salivary center in the superior and inferior salivatorius nuclei in the medulla oblongata. The superior salivatorius nucleus will pass on impulses to the submandibular gland and the sublingual gland, while the inferior salivatorius nucleus goes to the parotid gland, until salivary flow rate increases. The increased salivary flow rate will cause an increase in salivary organic and inorganic components. Component of saliva that have anti-bacterial effect and useful for oral health are immunoglobulin, mucin, lysozyme, lactoferrin and lactoperoxidase. Salivary flow rate increases directly relative to the increase in salivary pH, this is caused by an increase in bicarbonate levels. This is consistent with the results of this study that in smokers the average values of salivary flow rate ratio prior to and after consuming secang drink were 0.49(SD: 0.2) ml/minute and 0.62(SD: 0.3) ml/minute respectively. The average values of salivary pH ratio prior to and after consuming secang drink were 7.11(SD: 0.2) and 7.33(SD: 0.2) respectively.

An increase in salivary flow rate is associated with a higher bicarbonate concentration and thus with higher salivary pH, since the partial pressure of carbon dioxide (pCO₂) is relatively independent of low rate. Bicarbonate is known to be the major buffering ion of saliva.¹⁸

Based on previous research, long-term smoking significantly reduces salivary flow rate and increase oral disorder associated with dry mouth.¹³ This is due to cigarette smoke that contains free radicals and free radical generators in both gaseous and particulate phases that can cause tissue damage by reacting with polyunsaturated fatty acids at cellular membranes and nucleotides at DNA level the free radicals also can damage proteins on the cell surface.¹⁹ This damage will cause the salivary glands not to be able to function normally and decrease the rate of saliva secretion.

Oral tissues are the first target for gaseous and particulate products of cigarette smoking. The taste receptors which is primary receptor site for salivary secretion, are constantly exposed to the tobacco smoke during the smoking process.⁶ This process cause damage to

oral tissues which is degenerative changes of more than 40% of minor salivary glands.¹³ Irritate salivary glands on the hard palate which affect the rate of saliva secretion.

There are two types of salivary glands, the major and minor salivary glands. The first major salivary gland to be affected is the parotid gland that secretes of serous saliva. The loss of its function is compensated by the submandibular and the sublingual glands which secrete mucous saliva. This explains why thicker saliva is found in smokers,²⁰ and also reduced saliva secretion which eventually will increase the risk of oral disease and decrease the quality of life.

Saliva is the first biological fluid that is exposed to cigarette smoke, which contains numerous toxic compositions responsible for structural and functional changes in saliva.⁵ Cigarette smokes that enter oral cavity can cause the alteration of ptyaline enzyme activity in saliva.²⁰ Therefore, altered whole-mouth salivary flow rate has an important role in the pathogenesis of oral and dental disease, such as caries and periodontal disease.²¹

The presence of antioxidants in saliva originating from secang drink, are beneficial to counteract the harmful activities of free radicals as to protect structural and tissue integrity. However, when there are degenerative changes of salivary glands, the production of saliva will be reduced. Hence, the free radical activities will increase and continue to degenerate the function of salivary glands.

Nicotine is a specific organic compound contained in tobacco leaves. Inhalation of nicotine compound will cause psychological strain on smokers and make it addictive.²² Hence it is difficult for smokers not to smoke anymore. The amount of nicotine also gives effect on the taste of the smoker. The higher the level of the nicotine the better the taste of the smoke, whereas on the contrary, a low nicotine content may lead to the light taste or tasteless

The BMI characteristics of the students who are also smokers: 23 (76.6%) students have normal BMI, 2 (6.66%) students are underweight, and 5(16.66%) students are overweight. The average BMI is normal, this result is consistent with the outcomes of the Indonesian Basic Health Research (RIKERDAS) in 2013, that the majority of Indonesian students have normal nutritional status (70%).³ It is believed that smokers have lesser sensitivity towards taste. This assumption

is generated from the postulate that their tongues are covered with tars from the smoke. Since their BMIs in average are normal, smoke is considered for not having effects on BMI. But still, there are differences in the salivary flow rate. In this research, the student with the highest BMI (37.5), has salivary flow rate of 0.76, and salivary pH= 7,3, while the student with the lowest BMI (16.36) has salivary flow rate = 0.66, and pH 7,1. It appears that overweight people have greater salivary flow rate than underweight people.

Conclusions

This study concludes that secang drink consumption does increase the salivary flow rate and salivary pH in smokers, related to the body mass index.

Acknowledgements

The article is original, it has never been published before.

Declaration of Interest

The authors confirm that there are no known conflict of interest associated with this publication.

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