Jurnal Kedokteran dan Kesehatan: Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya
Volume 10, No 2. 2023/DOI: 10.32539/JKK.V10I2.20924
p-ISSN 2406-7431; e-ISSN 2614-0411

DIFFERENCES OF SHORT-TERM CONSUMPTION OF SEMENDO ROBUSTA AND ARABICA COFFEE TOWARDS SWEET TASTE SENSITIVITY

Alifia Salsabila[1], Shanty Chairani[1], Irfannuddin[2], Pudji Handayani[1], Nursiah Nasution[2]
[1]Dentistry Program, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia
[2]Department of Physiology, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia
Email: shanty.c@fk.unsri.ac.id
Received 29 Maret 2023; accepted 20 April 2023; published 24 Mei 2023

ABSTRACT

The most consumed and cultivated coffee in Indonesia is robusta and arabica coffee. Robusta and arabica coffee have different characteristics such as morphology, contents, and taste. Coffee consumption could cause alteration in taste sensitivity, especially sweet taste. Those could affect daily sugar consumption. The present study aimed to determine the differences of short-term consumption of semendo robusta and arabica coffee towards sweet taste sensitivity. This study used experimental study with a cross-over design approach that involved 21 students from the Faculty of Medicine Sriwijaya University. Semendo robusta and arabica coffee are used in this study. Sweet taste sensitivity was tested using the whole mouth test method by rinsed with sucrose solution at a concentration of 0,16, 0,32, 0,64, and 1,28 mol/l, which was given from the lowest concentration. Sweet taste sensitivity scores were rated at baseline and after the consumption of semendo robusta and arabica coffee which took place on different days. The lowest sucrose concentration that was correctly interpreted by the subject was noted as a taste sensitivity score. Data were analyzed using the Chi-square test. The chi-square test showed that the decrease in sweet taste sensitivity was more frequently happening after semendo arabica coffee consumption than semendo robusta coffee consumption ($p<0,05$). Short-term consumption of semendo arabica coffee has significantly increased the risk of sweet taste sensitivity reduction 4 times greater than semendo robusta coffee. There were differences in sweet taste sensitivity between short-term consumption of semendo robusta and arabica coffee.

Keywords: arabica coffee, robusta coffee, short-term consumption, sweet taste sensitivity

1. INTRODUCTION

Coffee is one of the most favorable drinking in Indonesian.[1] The most widely consumed and cultivated coffee in Indonesia is robusta coffee and arabica coffee. At this time, Indonesia is the third-largest coffee-producing country in the world. South Sumatera is a large coffee producer in Indonesia, which one of the regencies that produces coffee in South Sumatera is Muara Enim regency that produces semendo coffee.[2] Robusta coffee and arabica coffee have some specific characteristics. Robusta coffee has high caffeine content, low citric acid and water content, pH around 5,61-5,69 in brewed coffee, pleasant scent, and bitter taste, on the contrary, arabica coffee has low caffeine content, high citric acid and water content, pH around 5,16-5,23 in low brewed coffee, fruity scent, and slightly sour taste.[3] Coffee contains various chemical substances. The main content of coffee is caffeine and other contents such as chlorogenic acid, citric acid, trigonelline, polysaccharide, protein, carbohydrate, vitamin, mineral, and fat. Semendo robusta coffee has a higher caffeine content (2,10%), than semendo arabica coffee (1,17%).[4] Caffeine affects the bitter taste in brewed coffee. Other contents that affect the taste of coffee are chlorogenic acid and citric

acid.[3,5] Citric acid is one of the acids that have an effect on the sour taste in a brewed coffee.[3] Arabica coffee has a higher citric acid content (12,3 g/kg) than robusta coffee (8,6g/kg).[6]

Coffee consumption has positive effects, such as increased alertness and cognitive function, but when it is consumed excessively, it could cause negative effects on the human body such as insomnia and increased heart rate.[7,8] Coffee consumption also could lead to a decrease in taste sensitivity, especially sweet taste.[9]

Taste sensitivity is the ability of individuals to recognize certain tastes specifically in the lowest concentration. One of the tastes that most enjoyable by people is sweet.[10] The components that have roles in taste sensitivity are saliva, taste buds, taste receptors, nerves, and the central nervous system. Recognition of taste is begun when a taste substance like sucrose dissolved in saliva, bound with taste cells in taste buds, and activates GPCRs receptors, thus the neurotransmitter is released and accepted by afferent nerves, then transmitted to the central nervous system, as a result of this process perception of taste is formed.[11]

Some factors that can affect taste sensitivity are age, hormonal change, drugs consumption, systemic diseases, and certain food consumption.[12,13,14,15] Hormonal changes such as reduced level of estrogen in the menstruating and post-menopause women have been reported to be able in decreasing sweet taste sensitivity.[12] Individuals who often consume spicy food or vegan vegetarian who doesn't consume animal products and consume more beans and seeds have been reported could decrease sweet taste sensitivity.[13,14]

Coffee consumption might affect taste sensitivity because of its caffeine content. The caffeine content in coffee works as an antagonist against adenosine A2B receptor which plays a role in sweet taste transduction, if it is inhibited, it could give rise to a decrease in sweet taste sensitivity.[16] The decrease in sweet taste sensitivity that happened continuously tends to make individuals increase their daily sugar consumption, which will give the negative effects on the body and oral cavity such as caries, diabetes mellitus, and obesity.[17] This present study aimed to determine the differences of short-term consumption of semendo robusta and arabica coffee towards sweet taste sensitivity.

2. METHOD

This study used an experimental study with a cross-over design and all the procedures were approved by the Health and Research Ethics Committee (KEPPK), Faculty of Medicine Sriwijaya with an ethical clearance certificate number 052-2021. The study involved 21 students of the Faculty of Medicine Sriwijaya University, aged between 18-25 years old.

The subjects involved in this study were those who don't consume coffee at all or only consume coffee 1-2 times in 1 month. Subjects with a history of systemic disease, smoking, consuming alcohol and drugs or vitamins that affect taste sensitivity within the previous three month, menstruating and a pregnant woman were not involved in this study. All procedures were explained to the subjects then their informed consent was obtained.

Sweet taste sensitivity test was conducted at 08.00-10.00 WIB in room temperature (22-26^{o}C), on the first day using robusta semendo coffee and on the second day using arabica semendo coffee. All subjects were instructed to not consume any food or drink at least one hour before the test. Sweet taste sensitivity was tested by taking sucrose solution with a concentration of 0,16, 0,32, 0,64, and 1,28 mol/l, using the whole mouth method.[18]

Sweet taste sensitivity scores were ranged from 0 until 4.[19]

-Score 4: subject tasted sweet taste on concentration 1 (0,16 mol/l)
-Score 3: subject tasted sweet taste on concentration 2 (0,32 mol/l)
-Score 2: subject tasted sweet taste on concentration 3 (0,64 mol/l)
-Score 1: subject tasted sweet taste on concentration 4 (1,28 mol/l)

-Score 0: subject was not able to taste or interpreted wrongly all sweet taste concentrations.

Sensitivity taste was attained at baseline and after consumption of semendo robusta or semendo arabica coffee. Subjects were instructed to rinse with 10 ml sucrose solution for 30 seconds starting from the lowest concentration. Furthermore, subjects were instructed to rinse with aquadest then waited for 30 seconds before testing the next concentration. The lowest concentration identified correctly as sweet taste by the subject was noted as baseline score. Semendo coffee solution as much as 15 ml was drunk by subjects for 3 minutes and continued with the same sweet taste sensitivity test procedure as before.[20] The score after consumption of semendo robusta or arabica coffee was recorded. Sweet taste sensitivity was stated as decreasing after consumption of semendo robusta or arabica coffee if the obtained score was lower than the baseline score.

The chi-square test was used to determine the difference of sweet taste sensitivity after short-term consumption of semendo robusta and arabica coffee. A p-value less than 0,05 was considered statistically significant. If the difference was significant then the strength of the association was analyzed using an odd ratio value.

3. RESULTS

The characteristics of the subjects in this study can be seen in table 1.

Table 1. The characteristic data subjects

Characteristic	Subject	Percentage (%)
Gender		
Male	2	9,5
Female	19	90,5
Coffee consumption (in 1 month		
Never	9	42,8
1-2 times	12	57,2
Mean of sweet taste sensitivity score in baseline		
Semendo robusta coffee	4	
Semendo arabica coffee	4	
Mean of sweet taste sensitivity score after consumption		
Semendo robusta coffee	3,57	
Semendo arabica coffee	3,19	
Total	21	100

The mean value of sweet taste sensitivity score in the baseline for short-term consumption of semendo robusta and arabica was 4. The mean value of sweet taste sensitivity after short-term consumption of semendo arabica was lower than semendo robusta coffee. The number of the subject underwent decreasing and non decreasing in sweet taste sensitivity after consumption of semendo robusta and arabica coffee was shown in the diagram in figure 1, while the chi-square result was shown in table 2.

Table 2. The chi-square analysis of difference of sweet taste sensitivity after short-term consumption of semendo robusta and arabica coffee

Type of Coffee	Sweet Taste Sensitivity						p-value	Odd Ratio	95% CI	
	Decrease		No decrease		Total				Lower	Upper
	N	%	N	%	N	%				
Semendo arabica coffee	14	66,7	7	33,3	21	100	0,03	4,00	1,10	14,43
Semendo robusta coffee	7	33,3	14	66,7	21	100				

Chi-square test result at table 2 showed a p-value of 0,03, which mean that the decrease in sweet taste sensitivity significantly took place after consumption of semendo arabica coffee compared to semendo robusta coffee. OR value was 4,00 (CI 95%: 1,10-14,43), which showed that short-term consumption of semendo arabica coffee significantly could increase risk four times in decreasing sweet taste sensitivity compared to semendo robusta coffee.

3. DISCUSSION

The result of this study showed that short-term consumption of semendo robusta and arabica coffee lead to a decrease in sweet taste sensitivity. Those changes could be caused by caffeine which is the highest content in coffee that resulted in an alteration in sweet taste sensitivity.[4] This finding was supported by a study done by Choo et al which reported that short-term consumption of decaffeinated coffee that was added caffeine could lead to a decrease in sweet taste sensitivity compared to a coffee solution that was added quinine.[9]

The other content of coffee that might lead to alteration in sweet taste sensitivity is citric acid.[15] Citric acid is one of the acids that has an effect on the sour taste in a brewed coffee. That acid was formed during the roasting and fermentation process, thus resulted in the sour taste in a brewed coffee.[3] Junge et al have reported that a solution that consisted of sucrose and citric acid could lead to a decrease in sweet taste sensitivity compared to a solution that only consisted of sucrose.[15] The other acid content in coffee is chlorogenic acid. Chlorogenic acid content could affect the bitter and sour taste in a brewed coffee, additionally the bitter taste in a brewed coffee can also be affected by caffeine and trigonelline.[3,5] Chlorogenic acid undergoes Maillard and Strecker reaction that produces quinine, catechol, and other phenolic derivatives that increase the bitter taste in a brewed coffee.[5,21] The lower the caffeine, chlorogenic acid, and trigonelline content, the lower the bitter taste was produced.[22]

The result of this study showed that the decreasing sweet taste sensitivity after short-term consumption semendo arabica coffee was higher compared to semendo robusta coffee. The decreasing could be caused not only by the caffeine, but the citric acid could also play a role in it.[4,14] Semendo robusta coffee has higher caffeine content and more bitter taste, meanwhile semendo arabica coffee has higher citric acid content and more sour taste, which probably resulted in the decreasing sweet taste sensitivity after short term consumption semendo arabica coffee was found higher than robusta coffee.

The result of this study showed that short-term consumption of semendo robusta and semendo arabica coffee was proven to cause a decrease in sweet taste sensitivity. The effect of long-term consumption of coffee on sweet taste sensitivity still needs to be investigated furtherly. Individuals who experience a decreasing sweet taste sensitivity probably tend to increase their daily sugar consumption, which might produce the negative effects on the body and oral cavity, such as caries, diabetes mellitus, and obesity.[17] Those effects should be overcome by provided information for individuals who consume coffee to give more attention in their daily sugar consumption, though further research is needed regarding the

association between the type of coffee and consumption pattern of sugar, caries risk, and obesity.

4. CONCLUSIONS

Decreasing of sweet taste sensitivity after short-term consumption of semendo arabica coffee is higher than semendo robusta coffee.

REFERENCES

1. Napitulu RRJ, Kristinake RR. Pengaruh konsumsi kopi dalam jangka pendek terhadap kadar glukosa darah. Jurnal Dharma Agung Husada. 2019;6(2):88-95.
2. Widaningsih R. Buku outlook komoditas perkebunan kopi. Indonesia: Pusat Data dan Sitem Informasi Pertanian; 2019. p.27-33.
3. Aditya IW, Nocianitri AK, Yusasrini NLA. Kajian kandungan kafein kopi bubuk, nilai pH dan karakteristik aroma dan rasa seduhan kopi jantan (pea berry coffee) dan betina (flat beans coffee) jenis arabika dan robusta. Jurnal ITEPA. 2016;5(1):1-12.
4. Agustini S, Agustina S, Dharmaputra D. The determination of quality and sensory profile of arabica and robusta coffee originated from semendo Indonesia. In: Rudyat L, Savalas T, Hadisaputra S, editor. AIP Conference Proceedings. 2021 August 11-13; Mataram. Mataram; AIP Publishing. 2022;2638(1): 060002.
5. Ayelign A, Sabally K. Determination of chlorogenic acids (CGA) in coffee beans using HPLC. American Journal of Research Communication. 2013;1(2):78-91
6. Khapre Y, Kyamuhangire W, Njoroge EK, Kathurima CW. Analysis of the diversity of some arabica and robusta coffee from Kenya and Uganda by sensory and biochemical components and their correlation to taste. Journal of Environmental Science, Toxicology and Food Technology. 2017;11(10):39- 43.
7. Wachamo HL. Review on health benefit and risk of coffee consumption. Med Aromat Plants. 2017;6(1):1-12.
8. Cornelis MC. The impact of caffeine and coffee on human health. Nutrients. 2019;11(2):416.
9. Choo E. Picket B, Dando R. Caffeine may reduce perceived sweet taste in humans, supporting evidence that adenosine receptors modulate taste. Journal of Food Science. 2017;82(9):2177-82.
10. Bertali S, Laureati M, Battezzati A, Bergamaschi V, Cereda E, Spadafranca A, et al. Taste sensitivity, nutritional, status and metabolic syndrome implication in weight loss dietary interventions. World J Diabetes. 2014;5(5):717-23.
11. Sherwood L. Human physiology: from cell to system. 9th Ed. Singapore: Cengage Learning Asia Pte Ltd; 2014. p.224.
12. Chairani S, Putri A, Rusdiana S. Perbedaan sensitivitas pengecap pada masa ovulasi, menstruasi, dan pasca menopause. Dentika Dental Journal. 2013;17(3):207-11
13. Utami VE, Chairani S, Dewi SRP. Sensitivitas rasa dasar pengecapan pada individu dengan tingkat ketahanan terhadap pedas yang berbeda. In: Diansari V, Nasution AI, Sunnati, Mubarak Z, editor. Aceh Syiah Kuala Dental Meeting III PSKG FK Unsyiah. Proceeding Integration of Sciences, Clinical Skills and Technology to Improve Dental Advanced; 2013 April 12-13; Banda Aceh. Banda Aceh: PSKG FK Unsyiah; 2013. p.83-9.
14. Abbilardo T, Chairani S, Nasution N. Difference in taste sensitivity between vegan dan non vegetarian in Palembang, Indonesia. Journal of Indonesian Dental Association. 2020;3(1):24-30.
15. Junge YJ, Bertelsen AS, Mielby LA, Zeng Y, Sun YX, Byrne DV, et al. Taste interactions between sweetness of sucrose and sourness of citric and tartaric acid among Chinese and Danish consumers. Foods. 2020;9(10):1-18.
16. Poole RL, Tordoff MG. The taste of caffeine. J Caffeine Res. 2017;7(2):39-52.

17. Rippe JM, Angelopoulus TJ. Relationship between added sugars consumption and chronic disease risk factor: current understanding. Nutrients. 2016;8(11):1-19.
18. Wang JJ, Liang KL, Lin WJ, Chen CY, Jiang RS. Influence of age and sex on taste function of healthy subject. Plos One. 2020;15(6):1-16.
19. Tunggala S, Dewi N, Asnawati. Perbandingan sensitivitas lidah terhadap rasa manis dan pahit pada orang menginang dan tidak menginang di Kecamatan Lokpaikat Kabupaten Tapin. Dentino Jur Ked Gigi. 2016;1(2):169-71.
20. Chismirina S, Afrina, Safrianda CM. Perbandingan kecepatan laju aliran saliva sebelum dan sesudah konsumsi kopi robusta (*Coffea cannephora*). Cakradonya Dent J. 2016;8(2):88-91.
21. Sabarni, Nurhayati. Analisis kadar kafein dalam minuman kopi khop Aceh dengan metode spektroskopik. Lantanida Journal. 2018;6(2):103-202
22. Setyani S, Subeki, Grace HA. Karakteristik sensori, kandungan kafein, dan asam klorogenat kopi bubuk robusta (*Coffea canephora L*) di Tanggamus, Lampung. In: Prosiding Seminar Nasional PAPTI, Peran Ahli Tekonologi Pangan Dalam Mewujudkan Ketahanan Pangan Nasional;2017 Oktober 10-11;Bandar Lampung. Bandar Lampung;2017.p.98-107