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Effect of Consuming Brown Sugar Milk Coffee on Blood Pressure, Heart Rate and Blood Glucose Levels

Komang Krisna Dewi[1], Rachel Effrilya Kangliesky[2], Nabila Widi Pramesti[3]

[1]Department of Oral Biology, Faculty of Dentistry, University of Prof. Dr. Moestopo (B), Jakarta, Indonesia,12330

[2,3]Faculty of Dentistry, University of Prof. Dr. Moestopo (B), Jakarta, Indonesia, 12330

ABSTRACT

Background: Coffee is the main source of caffeine. Coffee is one of the most widely consumed beverages worldwide. Caffeine in coffee can affect the central nervous system, increase blood pressure and heart rate, and potentially cause hypertension. Coffee is served with various characteristics, flavors, and different ways of serving, one of which is palm sugar milk coffee or known as brown sugar milk coffee. Consuming coffee for 2-4 weeks in healthy adults can increase fasting insulin concentrations which reflect decreased insulin sensitivity, thereby increasing blood glucose concentrations. Blood glucose that is too high is called hyperglycemia. Long-term hyperglycemia can cause long-term health problems, namely diabetes, eye damage, kidneys, nerves, and problems with the oral cavity.

Objective: This study was conducted to determine the effect of consuming brown sugar milk coffee on blood pressure, heart rate and blood glucose levels.

Materials and Method: Analytical observational study with *Pretest-Posttest* study design. The subjects of the study were 18 students of Faculty of Dentistry, University of Prof. Dr. Moestopo (B) blood pressure and heart rate measurements were taken before and 45 minutes after consuming brown sugar milk coffee. Data analysis with the *Shapiro Wilk* normality test was continued with parametric statistical tests, namely the *Paired T-Test* Sample using the SPSS program.

Results: The results of statistical tests showed that there was an increase in systolic and diastolic blood pressure and a significant increase in blood glucose levels, but the heart rate decreased after 45 minutes after consuming palm sugar milk coffee.

Conclusion: Consuming brown sugar milk coffee can cause increased blood pressure and blood glucose levels, as well as cause a decrease in heart rate.

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I. INTRODUCTION

Coffee is one of the most consumed beverages worldwide. In 2020 to 2021, around 166.63 million 60 kg bags of coffee were consumed worldwide. In the same period, according to data from the International Coffee Organization (ICO), in Indonesia coffee consumption reached 5 million 60 kg bags.[1]

Coffee is currently served with a variety of characteristics, flavors, and ways of serving. One of them is black coffee which can be served with its original flavor or served with the addition of milk, creamer, and palm sugar as a sweetener. This palm sugar is processed from sap produced by several plants from the *Arecaceae* family, one of which is the sugar palm tree (*Arenga pinnata*). The sap produced by the sugar palm tree can be used as a raw material for palm sugar.[2]

Coffee is the main source of caffeine. Caffeine is a methylxanthine alkaloid compound that has a stimulating effect on the central nervous system and is addictive. The main reason people consume coffee is because of its taste and benefits. Some of the benefits of consuming coffee include increasing concentration, eliminating drowsiness, improving mood, helping physical performance by increasing endurance, and increasing muscle contractions. If consumed

excessively, coffee can have negative effects such as headaches, insomnia, feelings of restlessness, increased blood pressure and heart rate, changes in blood glucose levels, hallucinations, seizures, and arrhythmias.[3]

Blood pressure is the force exerted by the blood against the walls of blood vessels, consisting of systolic and diastolic blood pressure. Pulse is the number of heart beats per minute. According to the *American Heart Association* (AHA), normal blood pressure is less than 120 mmHg for systolic blood pressure, and less than 80 mmHg for diastolic blood pressure. The number of normal pulse beats per minute for adults ranges from 60 to 100 beats per minute. Blood pressure and heart rate are influenced by various factors, such as age, gender, diet, daily activities, alcohol consumption, smoking, sleep patterns, and the habit of consuming coffee containing caffeine.[4,5]

According to research conducted by Hara *et al*., caffeine contained in coffee can increase systolic and diastolic blood pressure without causing any effect on the heart rate in people who do not have a habit of consuming caffeine.[6] Ketelhut *et al*. stated that acute blood pressure increases due to caffeine consumption were not found in young adults with normal blood pressure.[7] Geethavani *et al*. from the results of their study showed an increase in heart rate of 4.4 beats per minute (bpm) from 72.9 bpm to 77.3 bpm after 60 minutes of consuming 5 mg/kg BW of caffeine.[8]

Coffee consumption is known to affect blood glucose levels which are closely related to diabetes mellitus. Increased blood glucose levels of ≥ 200 mg/dL accompanied by symptoms of polyuria, polydipsia, polyphagia, and unexplained weight loss can establish a diagnosis of diabetes mellitus.[9] Drinking coffee with milk and sugar has the potential to increase blood glucose levels. In a study conducted by Wong T, *et al*., it was proven that blood glucose levels spiked higher when drinking coffee with milk compared to black coffee.[10]

Based on the background description above, there are still differences in research results regarding increased blood pressure, heart rate and changes in blood sugar levels due to coffee consumption. The potential for increased blood pressure, heart rate and blood sugar levels can lead to systemic diseases such as hypertension and diabetes mellitus. Consumption of brown sugar milk coffee and sugar is currently a trend and is widely consumed by adolescents and young adults. Based on these facts, researchers want to know the effect of consuming brown sugar milk coffee on increased blood pressure, heart rate and blood glucose levels in students who are a group of young adults.

II. MATERIALS AND METHODS

The study was conducted at the Research Laboratory of the Faculty of Dentistry, Prof. Dr. Moestopo University (B) Jakarta – FKG UPDM (B). This study is an *Analytical Observational* study with a one group *Pretest-Posttest* design. The subjects of the study were 18 female students of FKG UPDM (B) Class of 2020. The subjects were aged 21-23 years with a body weight of 40-65 kg. Sampling was carried out by *Purposive Sampling* based on inclusion and exclusion criteria. The tools and materials prepared were a digital tensimeter, glucometer, coffee and palm sugar milk with a composition of 8 grams of robusta coffee powder extracted using a coffee machine and producing 30 grams of espresso, fresh milk weighed 91 grams, sweetened condensed milk weighed 18 grams and 100 ml of water. Stationery to record research results, gloves, masks, alcohol swabs, cloth plasters, sterile needles for blood collection and informed consent forms.

Measurements were taken in the morning, the research subjects were instructed to drink water and rest for 10 minutes, then the first blood pressure, heart rate and blood sugar levels were measured before being given treatment. Then the subjects were instructed not to eat and drink for 2 hours, after which the subjects were instructed to drink 200 ml of palm sugar milk coffee within a span of 5 minutes. Then the second blood pressure, heart rate and blood glucose levels were measured 45 minutes after the subjects drank brown sugar milk coffee. The data obtained in the study were analyzed using the SPSS (*Statistical Package for the Social Sciences*) program by conducting a normality test with the *Shapiro-Wilk Test.* The data is normally distributed if the significance value ($p>0.05$) and is not normally distributed if the significance value ($p<0.05$). If the data is proven to be normally distributed, the *Paired T-test* is continued to determine whether there is a difference in the values of blood pressure, heart rate and blood sugar levels before and after consuming brown sugar milk coffee. If the data is not normally distributed, the *Wilcoxon test* is used.

III.RESULTS AND ANALYSIS

The sample in this study consisted of 18 female FKG UPDM (B) students with an age range of 21-23 years, which can be described in Table 1.

Table 1. Age Distribution Table

Age (Years)	Frequency	Percent (%)
21	8	44.4
22	7	38.9
23	3	16.7
Total	**18**	**100**

The average results of blood pressure, heart rate, and blood glucose levels before and after consuming brown sugar milk coffee can be seen in table 2.

Table 2. Average Blood Pressure, Heart Rate, and Blood Glucose Levels Before and After Consuming Brown Sugar Milk Coffee.

Treatment	Palm Sugar Milk Coffee
Average Systolic Blood Pressure Before Treatment	103,89 mmHg
Average Systolic Blood Pressure After Treatment	109,72 mmHg
Average Diastolic Blood Pressure Before Treatment	75,11 mmHg
Average Diastolic Blood Pressure After Treatment	79,39 mmHg
Average Heart Rate Before Treatment	82,72 beats per minute
Average Heart Rate After Treatment	80,50 beats per minute
Average Blood Glucose Level Before Treatment	83,16 mg/dL
Average Blood Glucose Levels After Treatment	97,25 mg/dL

The increase and decrease in average blood pressure, heart rate and blood glucose levels can be seen in figure

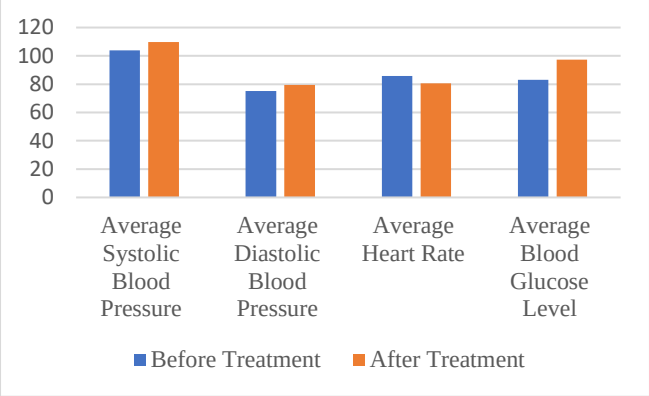

Figure 1. Average Blood Pressure, Heart Rate, and Blood Glucose Levels Before and After Consuming Brown Sugar Milk Coffee

Table 2 and Figure 1 show that the results of the study showed an increase in systolic and diastolic blood pressure, a decrease in heart rate, and an increase in blood glucose levels 45 minutes after consuming brown sugar milk coffee. The measurement data were then analyzed using the *Shapiro-Wilk Test* normality test. The results of the data normality test can be seen in Table 3.

Table 3. Data Normality Test Results

Treatment	**Sig.**	**df**
Systolic Blood Pressure Before Treatment	0,703	18
Systolic Blood Pressure After Treatment	0,855	18
Diastolic Blood Pressure Before Treatment	0,778	18
Diastolic Blood Pressure After Treatment	0,848	18
Heart Rate Before Treatment	0,575	18
Heart Rate After Treatment	0,374	18
Blood Glucose Level Before Treatment	0,346	18
Blood Glucose Level AfterTreatment	0,028	18

After the normality test is carried out, the research data will then be continued with parametric statistical tests, namely the *Paired T-Test* sample for normally distributed data (significance value $p>0.05$) and the *Wilcoxon test* (significance value $p<0.05$) for non-normally distributed data. The results of the parametric statistical test can be seen in table 4.

Table 4. Results of *Paired T-Test* Sample and *Wilcoxon Test*

Treatment	**Sig. (*2-tailed P*)**
Systolic Blood Pressure Before and After Treatment	0,006
Diastolic Blood Pressure Before and After Treatment	0,012
Pulse Rate Before and After Treatment	0,247
Blood Glucose Levels Before and After Treatment	0,000

Table 4 shows the results of the *Paired T-Test* Sample for systolic and diastolic blood pressure with a significance value of 0.006 ($p<0.05$) and 0.012 ($p<0.05$). Based on the test results, it can be concluded that there is a statistically significant difference in systolic and diastolic blood pressure before and after treatment. The results of the *Paired T-Test* Sample also show that the heart rate has a significance value of 0.247 ($p>0.05$) which means that there is no statistically significant difference between the heart rate before and after treatment. The results of the *Wilcoxon test* for blood glucose levels have a significance value of 0.000 ($p<0.05$) which indicates that there is a statistically significant difference between blood glucose levels before and after treatment. The results of this test indicate that the treatment given has a significant impact on systolic, diastolic, and blood glucose levels, but not on heart rate.

IV. DISCUSSION

This study was conducted to determine the effect of consuming coffee with palm sugar milk on increasing blood pressure, heart rate and blood glucose levels in FKG UPDM (B) students. Measurements were taken 45 minutes after coffee consumption because coffee that enters the body will

be distributed throughout the body by the bloodstream from the gastrointestinal tract in about 5-15 minutes, then the absorption of caffeine in the digestive tract reaches 99% and will peak in the bloodstream within 45-60 minutes.

Based on the data analysis from the statistical tests conducted, the results of the study showed that the treatment given had a significant impact on systolic blood pressure, diastolic blood pressure, and blood glucose levels, but not on heart rate. The results of this study are in line with the results of research conducted by Hara *et al*. stating that in people who do not have a habit of consuming coffee, caffeine can increase systolic and diastolic blood pressure without causing an effect on heart rate.[6] Wong, et al. stated that blood glucose levels will experience a high increase when consuming coffee with milk.[10]

Increased blood pressure after consuming coffee is caused by the main content in coffee, namely caffeine. Caffeine works as an adenosine antagonist, a neurotransmitter that causes vasodilation of blood vessels. When adenosine is blocked, blood vessels will experience vasoconstriction so that it can increase blood pressure. Caffeine also stimulates the adrenal glands to release catecholamines, such as adrenaline and noradrenaline. These hormones trigger an increase in heart rate and the strength of heart muscle contractions which can increase blood pressure.[11]

The decrease in heart rate after consuming brown sugar milk coffee is caused by several factors, such as the palm sugar content in coffee. The brown sugar milk coffee contains carbohydrates that can affect energy metabolism. Increased blood sugar levels after consuming coffee cause the body to respond by releasing insulin to regulate blood sugar levels which can affect electrolyte balance and heart function including decreasing pulse rate. The milk contained in coffee contains tryptophan which can affect heart rate. Tryptophan plays an important role in serotonin synthesis. Serotonin can affect the autonomic nervous system and heart function which can affect heart rate.[12]

This study proves that blood glucose levels in research subjects after consuming 200 ml of brown sugar milk coffee increased. The main factor in increasing blood glucose levels after consuming brown sugar milk coffee is the high sugar content in 200 ml of brown sugar milk coffee that exceeds the daily sugar intake limit, accompanied by the absence of physical activity of research subjects during the digestion process for 45 minutes before the second blood glucose level examination. Coffee is absorbed in the stomach and small intestine less than 45 minutes after intake and reaches maximum concentration in the blood 15-120 minutes.[13] Milk and cream are simple carbohydrates that can be digested and absorbed by the body within about 30 minutes to 1 hour after consumption.[14] So in the 45 minute interval before the second blood glucose level check, the brown sugar milk coffee has begun to be digested and absorbed by the body. Therefore, it is not recommended to consume more than two glasses of brown sugar milk coffee or the equivalent of 400 ml per day. The sugar requirement in our body may be more than 4 grams or one teaspoon per day. This can cause someone to be in the prediabetes phase or the results of the 2-Hour Post-Meal Blood Glucose Examination (GD2PP) of 140-199 mg/dL and if hyperglycemia lasts for a long time it will cause diabetes. The pancreas releases glycogen, a hormone that targets cells in the liver, then these cells convert glycogen into glucose, this process is called glycogenesis. Glucose is released into the bloodstream, so that blood glucose increases.[15]

Diabetes can cause several manifestations in the oral cavity, such as gingivitis, periodontitis, loss of gingival attachment, increased degree of tooth mobility, xerostomia, burning mouth syndrome, pain on percussion, alveolar bone resorption and tooth loss. Diabetes mellitus causes a condition of salivary gland secretion dysfunction called xerostomia, where the quality and quantity of saliva production in the oral cavity decreases and causes candidiasis.[16]

Consumption of coffee containing caffeine can also potentially cause increased blood pressure which can lead to hypertension. Hypertensive patients are at higher risk of complications in surgical procedures, especially treatments involving local anesthesia with vasoconstrictors (epinephrine). Consumption of brown sugar milk coffee before a treatment procedure has the potential to cause side effects in dental procedures for hypertensive patients.[17]

CONCLUSION

Based on the research and data analysis that has been done, it can be concluded that consuming brown sugar milk coffee can cause an increase in blood pressure, both systolic and diastolic, and an increase in blood glucose levels, and cause a decrease in heart rate 45 minutes after consuming brown sugar milk coffee. Further research is needed with different sample populations, number of samples, gender variations, types of coffee, frequency of coffee consumption, different levels of coffee, but with constant sugar and milk levels.

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