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Research Article

The effect of Coffee on some cardiovascular parameters in hypertensive and normotensive patients at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, (COOUTH), Awka, Nigeria

[1] Azikiwe CCA, [1] Chijioke C, [1] Ogbonna BU, [2*] Nwaneli CU, [4] Egbunike JO, [3] Chukwuka FC Ogbuefi

[1] Department of Pharmacology and Therapeutics, Chukwuemeka Odumegwu Ojukwu University (COOU), Awka, Nigeria

[2] Department of Internal Medicine, Nnamdi Azikiwe University, Nnewi, Nigeria

[3] GOPD, Federal University Teaching Hospital, Owerri, Nigeria

[4] GOPD, University of Abuja Teaching Hospital, FCT, Nigeria

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For Correspondence:

Dr Nwaneli Chibundo Uchenna, Department of Internal Medicine, Nnamdi Azikiwe University, Nnewi campus, Nigeria

Abstract

Background: Hypertension is a common disorder among blacks. Limiting coffee consumption may be beneficial in controlling hypertension. Studies have reported some health benefits of coffee consumption however it has been documented that coffee is associated with acute elevation of blood pressure and perhaps leading to chronic hypertension and poor control. The effect of coffee consumption on cardiovascular system in black population in Africa has not been well studied.

Aim: The aim of this study is to determine the acute effects of coffee on some cardiovascular parameters in hy pertensive and normotensive patients at a tertiary health institution in South - East region of Nigeria.

Method: 500 adul t volunteers who met the inclusion criteria consisting of 250 hypertensive patients and 250 normotensive individuals participated in the study. 2grams of coffee granules were dissolved in 200ml of hot water and served to study participants. Basal values of blood pressure, Pulse rate and finger oxygen saturation (SPo2) were obtained before consumption. These parameters were then measured at 15mins post consumption and at every 30mins intervals for 5hours. Data was analysed using SPSS version 29. Mean, Standard deviation (SD), Standard error of the mean (SEM) and P-values were calculated.

Results: The hypertensive group consisted of 135 females and 115 males with a mean age of 57.72±11.55 while the normotensives consisted of 112 femal es and 138 males with a mean age of 50.10±11.90. From 30mins to the first 2 hours post consumption there was a significant elevation of systolic blood pressure (P≤0.001) as well as the diastolic pressure (P≤0.001) in both hypertensive and normotensive group. At 4 hours post consumption, the blood pressures of both study groups have returned to the baseline values. The pulse rate of both groups started rising about 15 minutes post coffee intake. The pulse rate of both groups started dropping 2 hours post coffee administration. At 3 hours, pulse rates of both study groups had returned to their basal levels. The oxygen saturation (SpO2) in both groups did not vary from baseline till end of the study.

Conclusion: Coffee caused transient elevation of blood pressure and increased heart rate from baseline in both hypertensive patients and normotensives. This observation may necessitate review of recommendation physicians give to hypertensive patients to modify the rate of consumption of coffee to achieve a better control of blood pressure

Keywords: Coffee; Hypertension; Blood pressure; Pulse rate ; Oxygen saturation

INTRODUCTION:

Hypertension is defined as persistent repeated office blood pressure of equal to or above 140mmHg systolic and or diastolic blood pressure of equal to or above 90mmHg in adults of 18 years and above[1].

According to the European Society of Cardiology (ESC) and European Society of Hypertension (ESH)guidelines of 2024, blood pressures has been reclassified into three broad categories.

TABLE 1: Blood Pressure Classifications[1]

Category	SBP (mm Hg)	DBP (mm Hg)
Non Elevated Blood pressure	<120	and <70
Elevated Blood pressure	120-139	or 70-89
Hypertension	>140	Or > 90

Abbreviations: *SBP = systolic blood pressure ; DBP = diastolic blood pressure; mm Hg = millimeters of Mercury*

Management of hypertension requires non-pharmacological measures including regular physical exercise, reduction in salt intake, increased potassium intake, reduction in alcohol consumption, maintenance of ideal body weight , quitting tobacco consumption.[2] The prevalence of hypertension is higher in African Americans and blacks compared to their Caucasian counterpart.[3] Studies have also shown that hypertension severity is worse in blacks and African Americans with more severe complications and lower control rates[3,4] .

Coffee has been a beverage consumed in different parts of the world. It is known to have several biologically active substance which affect the human body system.. Coffee contains a myriad of compounds that may be beneficial or harmful. The most abundant bioactive of these compounds in coffee are caffeine, diterpenes and polyphenols.[5]

Several studies have demonstrated beneficial effects of coffee consumption on the cardiovascular system with positive effect on stroke and prevention of heart failure while other studies did not show significant beneficial effect[6-11]

Coffee and its active substance caffeine when taken orally is known to activate the sympathetic nervous system and increase blood pressure and heart rate. The long term effect of coffee consumption on blood pressure in hypertensive patients have been subject of debate and inconclusive. Some studies documented the effect to be transient and does not affect control of blood pressure in the long term while some systematic review found slight negative effect on blood pressure control.[12-14]. Whayne TF[11] in a systematic review found no long term effect on blood pressure with a lower risk of diabetes on moderate consumption of 3-5 cups daily.

There are no studies known to the authors conducted in Nigeria to investigate the acute effect of coffee intake on hypertensive and normotensive individuals. There is high prevalence of hypertension in Nigeria and control rate is also very low.[4] Coffee may be contributing to the incidence of hypertension and its poor control rate in Nigerian population and blacks in general. This study seeks to investigate the acute effects of coffee on physiological parameters such as blood pressure, pulse rate, finger oxygen saturation.

AIM: The aim of this work is to demonstrate acute effects of coffee on blood pressure , pulse rate and finger oxygen saturation in hypertensive and normotensive patients at COOUTH, Awka. South East Nigeria. We set out also to do a comparative analysis of the data obtained from the study group.

METHOD:

This is s hospital based study at COOUTH, Awka, South East Nigeria with over a thousand registered out patients. Study design was Comparative vertical study. Minimum sample size calculated was 397 and was extrapolated to 500.

Materials: Blood Pressure(BP) Device Omron 2900, Pulse- Oximeter, Nescafe coffee, Sugar cubes, Drinking water, Cups and Spoons.

Inclusion criteria: Any known adult hypertensives of at least a year and have been attending cardiology clinics. Normotensives adult with a BP of <120/80 without co morbidities in the exclusion criteria .

Exclusion Criteria: Hypertensive individuals and the normotensive controls with co-morbidities such as Diabetes , Kidney disease , Malignant disease , Asthma , Epilepsy.

Ethical approval was obtained from the institution's ethical committee. Informed consent was obtained from the study participants.

Demographic information was obtained including age , sex , occupation, health status . A total of 500 volunteers participated in the study. Coffee granules (Nescafe brand) were dissolved (2g/200ml) and served hot. Baseline values of blood pressure, Pulse rate and finger oxygen saturation(SPo2) were obtained before consumption. Participants drank the cup of coffee conveniently within a maximum time of 30minutes. These parameters were measured at 15mins post consumption and at every 30mins intervals for 4 to 5hours. A pilot negative control groups drank only sweetened hot water.

Data Analysis: Data was analysed using SPSS version 29. Mean, Standard deviation, Analysis of variance (ANOVA) , P values, Standard error of the mean (SEM) , were determined for the groups of participants. P values less than 0.05 were adjudged as significant

RESULTS

Demography of Participants.

The hypertensive group comprised 115 males(46%) and 135 females (54%), while the normotensive group consisted of 138 males and 112 females as shown in table 2.

TABLE 2: Gender distribution of the study participants

GENDER	HYPERTENSIVE	%	NORMOTENSIVE	%
MALE	115	46	138	55.2
FEMALE	135	54	112	44.8
TOTAL	250	100	250	100

The mean age of the hypertensive group was 57.72 years (±11.55), while the mean age of the normotensive group was 50.10 years (±11.90). The majority of hypertensive participants (74) were in the 51-60 age range, while the majority of normotensive participants (72) were in the 41-50 age range as shown in table 3

TABLE 3: Age range of the study participants

Age (Years)	Hypertensive (n=250)	Normotensive (n=250) |
30-40:	28	32
41-50:	48	72
51-60:	74	62
61-70:	68	54
71-80 :	32	30
Mean ± SD	57.72 ± 11.55	50.10 ± 11.90 |

Coffee effects on systolic and diastolic blood pressure, heart rate and SPO2

From 30mins to the first 2 hours post consumption there was a significant elevation of systolic blood pressure (P≤0.001) as well as the diastolic pressure (P≤0.001) of known hypertensive.

A similar pattern of effect was also observed in systolic and diastolic blood pressures of the normotensive. At 4 to 5 hours post consumption, the blood pressure of both the hypertensive group and normotensives has decreased back to their baseline levels.

From 15 minutes post consumption, heart rates in both study groups were seen to continuously rise but, stated dropping 2 hours post. At 3 hours, heart rates of both study groups had returned to their basal levels. The oxygen saturation pressures (SpO_2) were essentially normal in both study groups (Tables 4-7).

TABLE 4: Coffee effects on Mean diastolic blood pressure (DBP) of hypertensive, SEM, confidence intervals (CI) and P.values

Time	Mean DBP	SEM	95% CI	P-value
0	**90.38±0.49**	**89.417**	**91.343**	**< 0.000**
15	**87.24±0.48**	**86.29**	**91.81**	**<0.001**
30	**88.94±0.54**	**87.873**	**90.015**	**<0.001**
60	**90.86±0.55**	**89.769**	**91.943**	**<0.001**
90	**91.0±0.53**	**89.969**	**92.039**	**<0.001**
120	**91.34±0.56**	**89.979**	**92.041**	**<0.001**
240	**93.10±0.57**	**89.100**	**93.042**	**<0.001**
300	**90.86±0.55**	**89.769**	**91.943**	**<0.001**

TABLE 5: Coffee effects on Mean systolic blood pressure (SBP) of hypertensive, SEM, Confidence intervals(CI) and P.values**:**

Time	Mean SBP	SEM	95% CI	P-value
0	**141.27±0.71**	**139.88**	**142.67**	**0.000**
15	**141.12±0.71**	**139.71**	**142.52**	**0.734**
30	**142.42±0.80**	**140.84**	**143.99**	**0.064**
60	**144.30±0.71**	**142.89**	**145.70**	**<0.001**
90	**144.40±0.70**	**143.02**	**145.78**	**<0.001**
120	**145.10±0.71**	**143.40**	**146.70**	**<0.001**
240	**145.20±0.75**	**143.46**	**146.78**	**<0.001**
300	**142.42±0.80**	**140.84**	**143.99**	**0.064**

TABLE 6: Coffee effects on Mean diastolic blood pressure (DBP) of non -hypertensive, SEM, confidence intervals(CI) and P.values**:**

Time	Mean DBP	SEM	95% CI	P-value .
0	77.960±0.562	76.854	79.066	0.000
15	78.064±0.568	76.946	79.182	0.783
30	80.056±0.402	79.264	80.848	<0.001
60	85.500±0.419	84.674	86.946	<0.001
90	86.208±0.375	85.470	86.946	<0.001
120	88.106±0.402	86.279	86.04	<0.001
240	89.105±0.510	86.526	86.044	<0.001
300	77.960±0.562	76.854	79.066	<0.943

TABLE 7: Coffee effects on Mean systolic blood pressure (SBP) of non hypertensive, SEM, confidence intervals and P.values**:**

Time	Mean SBP	SEM	95% CI	P-value
0	118.28±0.402	117.488	119.072	0.000
15	118.24±0.399	117.454	119.026	0.943
30	118.28±0.402	117.488	119.072	1.000
60	124.23±0.532	123.180	125.276	<0.001
90	124.84±0.426	128.000	119.680	<0.001
120	126.42±0.562	128.18	126.146	<0.001
240	126.6±0.568	128.478	126.286	<0.001
300	119.01±.577	116.344	122.201	0.075

DISCUSSION:

Hypertension and elevated blood pressure is a leading cause of heart disease, stroke and chronic kidney disease globally with a higher prevalence in low and middle income countries[15,16]

Our study demonstrated that coffee consumption is associated with transient but significant rise in blood pressure in both hypertensive and normotensive patients. There is equally a significant rise in pulse rate in both the hypertensive and normotensive subjects. There was no effect on peripheral oxygen saturation.

Our study result was similar to findings by Nurminem at al [13] who found in a systematic review of many studies from 1966- 1999 that coffee caused significant acute rise in blood pressure after consumption which was worse in hypertensive patients. In some patients they observed there was long effect on hypertension on chronic consumption while is some patients it appeared that tolerance to coffee developed and there was no significant effect on blood pressure on the long term. Another systematic review of studies on coffee effect on blood pressure and cardiovascular disease in hypertensive individuals by Mesas et al [12] reported that coffee intake produces an acute rise in blood pressure lasting 3 hours or more. This agrees with our own study observation. They also reported that there was no effect of chronic coffee consumption on blood pressure.

Our findings are different from the study done in Kano by Lamina Sikiru and Musa D[18] who found no significant difference in the blood pressure and heart rate in their own subjects.The different outcome can be attributed to a small sample size of twenty compared to two hundred and fifty used in our study. Also their study subjects were normotensive and much younger with mean age of twenty two years. Our study outcome was also different from study by Ramli NN et al [17] who studied the effects of coffee on several parameters including blood pressure , blood sugar ,lipids and waist circumference. The study demonstrated reduction on both systolic blood pressure and diastolic blood pressure as well as reduction in blood sugar and lipids.

Some local studies have associated coffee drinking with hypertension however these studies are cross sectional studies based on self reported consumption of coffee[19-23]. However there were other variables that were associated with hypertension such as obesity, tobacco smoking and alcohol intake.

In a case report, Odike et al [24] reported a case of hypertension that was linked to long term coffee intake which resolved on abstaining from coffee for many months. This report lends credence to the fact that

coffee may predispose certain individual to hypertension.

Our study demonstrated that coffee consumption raises the pulse rate of both hypertensive and non hypertensive patients few hours. This was similar to the study by Syed et al[25] who also found a statistically significant increase in heart rate, systolic and diastolic blood pressure of their study population at 30 minutes and 30 minutes after coffee intake. The study subjects abstained from coffee at least 12 hours before the commencement of the study. However, by Shufen et al[26] did not show a significant change in resting heart rate by coffee consumption. However, their study was done on people consuming coffee on chronic basis over a period of 2 weeks and 24 weeks. The body would have adapted to the effects of the coffee on the body physiology.

There was no change in the peripheral oxygen saturation measured by finger pulse oximeter after coffee consumption.

CONCLUSIONS

Our study demonstrated that coffee drink significantly led to increase in blood pressure and pulse in individuals who have hypertension and those without hypertension. This may have implication in long term control of blood pressure in hypertensive individuals. There may be need to limit coffee consumption in hypertensive patients especially in black population in Africa where control of hypertension is still abysmally low.

Competing Interest: The authors have no competing interest to declare.

Ethical approval: Ethical approval was obtained from the institution's ethical committee. Informed consent was obtained from the study participants.

Author Contributions: All authors have equal contributions in the preparation of the manuscript and compilation.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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