SAR Journal of Medical Biochemistry

Abbreviated Key Title: *SAR J Med Biochem*
Home page: https://sarpublication.com/journal/sarjmb/home
DOI: 10.36346/sarjmb.2022.v03i03.004

ISSN 2707-7721 (P)
ISSN 2709-6882 (O)

Original Research Article

Caffeine's Effect on Blood Pressure in Sudanese Women in East Gezira State-Sudan, 2018

Abderrhman Ahmed Mohamed Ismaeil[1], Nahla Ahmed Mohammed Abderahman[2], Mohammed Ahmed Ibrahim Ahmed[3], Nihal Abdalla Ahmed Abdalla[4], Mosab Nouraldein Mohammed Hamad[5*]

[1]Associate Professor of Physiology, Faculty of Medicine, Sinnar University, Sinnar State, Sudan
[2]Assistant Professor of Biochemistry, Faculty of Medicine, Department of Biochemistry, Nile Valley University, Atbara, Sudan
[3]Assistant Professor of Microbiology, Faculty of Medicine, Department of Microbiology, Nile Valley University, Atbara, Sudan
[4]MBSc. Student, Faculty of Medicine, University of Gezira, Wad Madani, Sudan
[5]Head of Parasitology Department, St. Joseph University in Tanzania, Dar Es Salaam, Tanzania United Republic, Brigitta Campus, Tanzania

***Corresponding Author:** Mosab Nouraldein Mohammed Hamad
Head of Parasitology Department, St. Joseph University in Tanzania, Dar Es Salaam, Tanzania United Republic, Brigitta Campus, Tanzania

Article History: | Received: 12.05.2022 | Accepted: 17.06.2022 | Published: 22.06.2022 |

Abstract: ***Background:*** Caffeine is a significant component of coffee, which is one of the most extensively, consumed non-alcoholic beverages. Caffeine is a methylxanthine-class central nervous system stimulant that is one of the most extensively utilized medications on the planet. Caffeine stimulates the central nervous system and is perhaps the most extensively used psychoactive stimulant. It causes gastrointestinal disturbances, tremor, headache, and sleeplessness, palpitations, cardiac arrhythmias, and it has been proposed that caffeine is possibly hypertensive. ***Aim***: The goal of the study was to see how caffeine affected the blood pressure of Sudanese adult females in Gezira state's east during July and August 2018. ***Methods:*** A descriptive cross-sectional prospective study of 400 females aged 18 to 70 years old from various areas of Gezira State was conducted. Caffeine was not consumed by the participants for 12 hours before to the test. Blood pressure was monitored at baseline after 20 minutes of rest, then 45 minutes later after consuming a 150 mL cup of boiling coffee (120 mg caffeine) (each cup contain teaspoon 10 g of coffee powder). A questionnaire was created to collect personal and demographic information. Body mass index (BMI) was computed after measuring weight and height. ***Results:*** The researchers discovered that 120 mg of caffeine increased systolic blood pressure by 5 to 18 mmHg, diastolic blood pressure by 6 to 16 mmHg, and mean blood pressure by 3 to 13 mmHg. Caffeine had a higher effect in older and hypertensive people, according to the study, with a P value of <0.0001. With regular coffee consumption, there was no tolerance to the pressure impact of caffeine, according to the study. There was also racial variance in the caffeine presser response, with the Tama tribe having a stronger response and the Rufaah tribe having a higher baseline BP (P value is <0.0001). In addition, the prevalence of hypertension was 5.8% lower in rural areas. ***Conclusion:*** Caffeine raises systolic, diastolic, and mean blood pressure in Sudanese adult females, with a particularly noticeable effect on the elderly and hypertensive.

Keywords: Caffeine, Blood Pressure, East of Gezira State, Sudan.

INTRODUCTION

Caffeine (1, 3, 7-trimethylxanthine) is a naturally occurring alkaloid found in coffee, tea, cocoa, cola nuts, and other plants. It's perhaps the most often consumed pharmacologically active ingredient on the planet, appearing in everyday beverages (coffee, tea, and soft drinks), items containing cocoa or chocolate, and drugs, such as headache and pain relievers (Murphy and Benjamin 1981). Caffeine is mostly found in coffee (60–75 percent) and tea (15–30 percent) in adult diets, whereas it is also found in caffeinated soft drinks and chocolate in children's diets. Caffeine content is highest

Citation: Abderrhman Ahmed Mohamed Ismaeil, Nahla Ahmed Mohammed Abderahman, Mohammed Ahmed Ibrahim Ahmed, Nihal Abdalla Ahmed Abdalla, Mosab Nouraldein Mohammed Hamad (2022). Caffeine's Effect on Blood Pressure in Sudanese Women in East Gezira State-Sudan, 2018, *SAR J Med Biochem*, 3(3), 51-57.

in brewed coffee (56–100 mg/100 ml), next instant coffee and tea (20–73 mg/100 ml), and cola (–19 mg/100 ml).Cocoa and chocolate products are also substantial sources of caffeine (e.g. 5–20 mg/100 g) (Dlugosz and Bracken 1992), (Dlugosz and Bracken 1992). The amount of caffeine consumed in beverages varies greatly and is influenced by the strength of the drink as well as the volume consumed, with cup size playing an important effect. More caffeine is found in Coffeacanephora (Robusta) than in Coffea Arabica (Arabica) (Harland, 2000). Caffeine is used as an adjuvant in many prescription and over-the-counter medications, such as in combination with non-steroidal anti-inflammatory drugs, analgesic formulations, and ergotamine in migraine medications (Chou & Benowitz,1994), and in combination with phedrine to help obese people lose weight (Astrup *et al.*, 1992). As a psychoactive substance, it has a variety of stimulatory effects on the central nervous system, including increasing respiratory rate and causing bronchodilation, stimulating lipolysis, increasing diuresis, gastrointestinal disturbances, tremor, headache, insomnia, causing palpitations, and occasionally even cardiac arrhythmias. Caffeine has so been suggested to be possibly hypertensive (Chou & Benowitz, 1994; Mehta *et al.*, 1997). Caffeine consumption of >500–600 mg per day (four to seven cups of coffee or seven to nine cups of tea) is now largely considered to pose a major health risk and may thus be classified as 'abuse.' Caffeinism is a syndrome characterized by a variety of negative reactions such as restlessness, anxiety, irritability, agitation, muscle tremor, insomnia, headache, diuresis, sensory disturbances (e.g. tinnitus), cardiovascular symptoms (e.g. tachycardia, arrhythmia), and gastrointestinal complaints (e.g. nausea, vomiting, diarrhoea) in response to long-term caffeine abuse (James and Paull 1985). Caffeine consumption above 400 mg per day may raise the risk of detrusor instability (unstable bladder) in women. Even moderate coffee use (200–400 mg per day) may raise the likelihood of detrusor instability in women who already have bladder symptoms (Arya *et al.*, 2000). Excessive caffeine use does not usually result in death, and just a few examples have been documented in the literature. In adult humans, the acute fatal dose is estimated to be 10 g/person. A patient died after consuming 6.5 grams of caffeine, yet another patient survived after consuming 24 grams of caffeine (Stavric 1988). Caffeine's antagonistic effects on adenosine receptors: Caffeine's main mechanism of action is adenosine receptor antagonism. Adenosine is a purine that is released locally and acts on several receptors to enhance or decrease cellular cyclic adenosine monophosphate concentrations (cAMP). At amounts reported in humans receiving caffeine from dietary sources, caffeine selectively blocks adenosine receptors and competitively suppresses adenosine activity. Caffeine causes the release of norepinephrine, dopamine, and serotonin in the brain, as well as an increase in circulating catecholamines, indicating that adenosine's inhibitory effect has been reversed (Benowitz 1990). It also affects vascular tone by inhibiting phosphodiesterases, causing cyclic AMP and cyclic GMP levels to rise. In humans, caffeine causes vasoconstriction, whereas enprofylline, a xanthine derivative with potent phosphodiesterase inhibitory properties, causes vasodilation. Thus, phosphodiesterase inhibition does not appear to be the primary mechanism regulating caffeine's cardiovascular effects (Smits *et al.*, 1989). Individuals who drink caffeine-containing beverages on a regular basis may acquire a physical, emotional, and psychological dependence on them, and may experience caffeine withdrawal syndrome if they stop abruptly. Coffee and other caffeine-containing beverages are extensively consumed on a daily basis; consequently, it is critical to define the potential hazards and advantages of caffeine consumption in order to properly inform both health professionals and the general population. Coffee's influence on blood pressure has been studied extensively, with mixed results. Despite several researches over the years, it is still unclear if caffeine raises blood pressure simply under optimal laboratory circumstances or creates a clinically significant pressure response when used regularly in everyday activities. Sudanese people drink a lot of coffee, and while there is a lot of research on the impacts of coffee all over the world, there are no local studies, therefore we need to look into our Sudanese coffee and how it affects blood pressure.

SUBJECTS AND METHODS

Study Design

From July to August 2018, a cross-sectional prospective cohort descriptive community-based study was done in the east of Gezira state, Sudan.

Study area and population

The participants in this study were 400 Sudanese women. It took place in four villages in Gezira state's east: Elshareef Yagoub, Elbugasa, Gaber, and Elshabarga, which were separated into four tribes: Ashraf, Musallameah, Rufaah, and Tama, who lived on the Elgadareef - Portsudan route surrounding the Elrahad river, some 40 kilometers from Wad-madani city. Except for the Tama people, the majority of the females enrolled in this study were housewives. Even in the morning, these person was known for sipping coffee.

Inclusion criteria: Coffee drinkers and those over the age of 18 are eligible.

Exclusion criteria: Females who refuse to consent to the study, pregnant women, and non-Sudanese women are also excluded.

Sampling technique

A systematic random sampling technique was used to pick the sample (probability sample). Every

day, 20 girls gathered in one location to conduct simultaneous investigations. Participants were instructed to unwind for 20 minutes. A baseline blood pressure reading was taken. Each participant was given a 150 mL cup of coffee containing a teaspoon (10 g) of coffee powder, and they were encouraged to relax for 45 minutes. Coffee was made in the same way and with the same concentration for all participants and did not contain any flavors. Caffeine was prohibited for 12 hours before to the test for all participants. Blood pressure was taken once again. All participants completed a questionnaire that included personal information, coffee use, medical and family history of hypertension, history of chronic disease and medication, body weight, and height.

Ethical Considerations

The research and ethical committee of the faculty of medicine at the University of Gezira approved the study, and signed consent was obtained before it began. All participants were guaranteed that their personal data would be kept private.

Statistical Analysis

SPSS-20 was used to analyze the data from this investigation (Statistical Package for Social Sciences version 20). Means and standard deviations were calculated, and the paired sample T test was used to compare mean blood pressure, pulse pressure, and systolic and diastolic blood pressure before and after coffee consumption. At <=0.05, the P-value was considered significant.

RESULTS

The research was conducted between July and August of 2018. A total of 400 Sudanese females were included in this study with age above 18 yrs. old grouped as follows; 18 to 45yrs (81%), 46 to 70 years (14%), above than 70 yrs. (5%) as shown in Figure 1, belonging to four different tribe; Ashraf (55%), Rufaah (27%), Tama (13%) and Musallameah (5%) as in Figure 1 & 2.

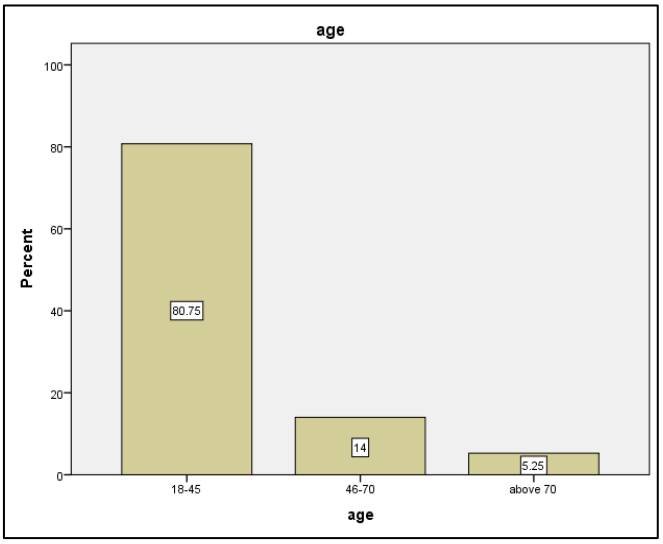

Figure 1: Age group frequency among participants

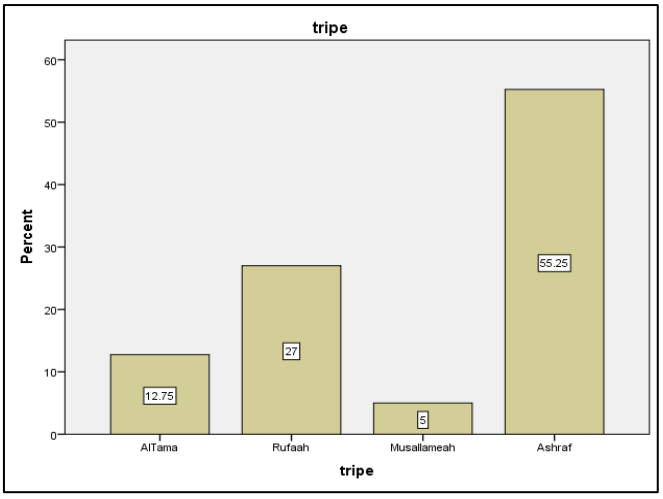

Figure 2: Percent of participant in tribes

Figure 3 showed (43%) of 400 female participants said they drank coffee every day and only 35 people (9%) out of 400 had palpitations after drinking coffee. Only 35 persons out of 400 (8.75%) were found to develop a palpitation after drinking coffee Figure 4.

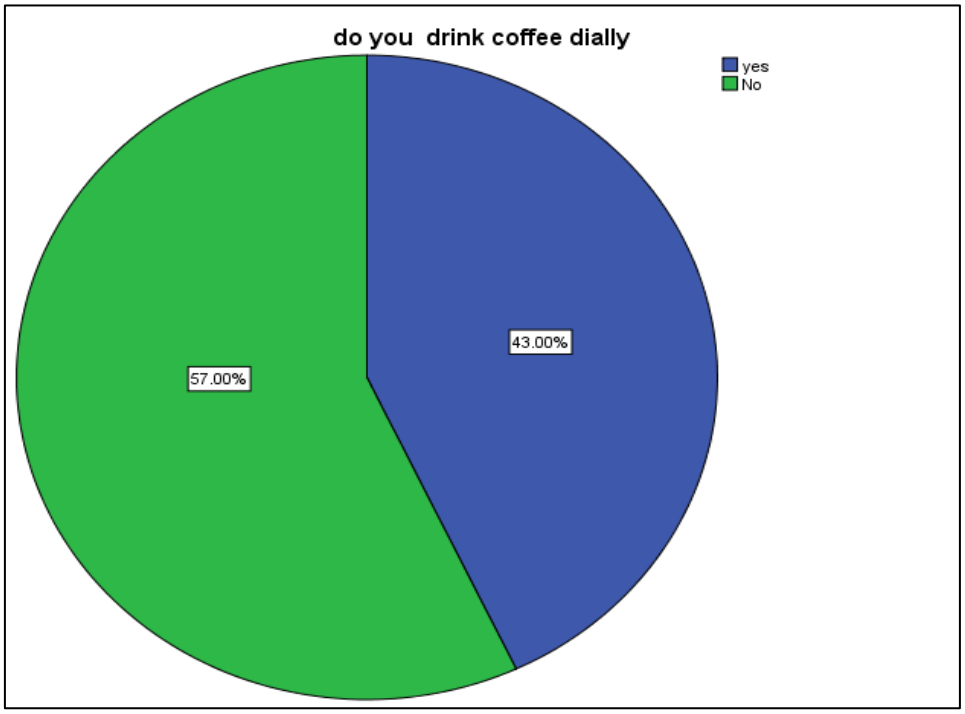

Figure 3: Daily consumption of coffee

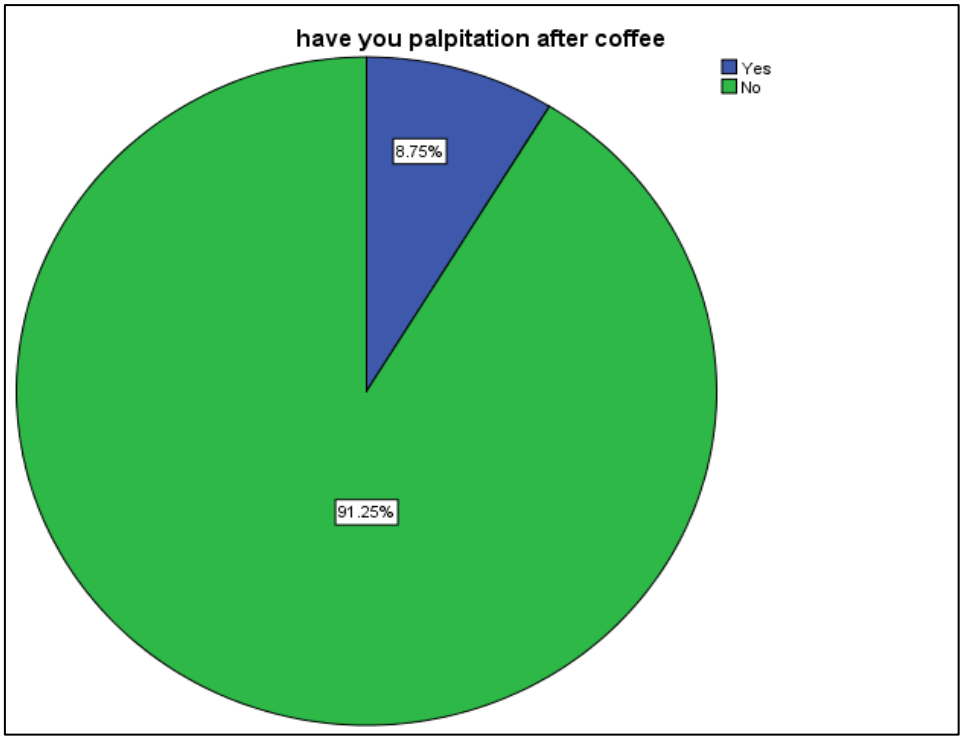

Figure 4: Development of palpitation after intake of coffee

205 (51%) females had family history of hypertension, and 23 (6%) females were hypertensive; 18 of them on medical treatment and 5 on diet control as shown in Figure 5 and 6 respectively.

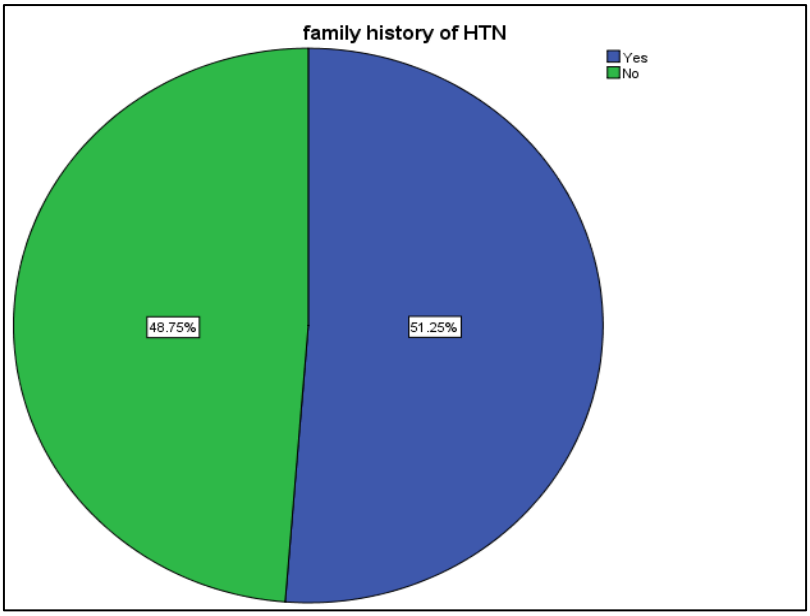

Figure 5: Family history of hypertension

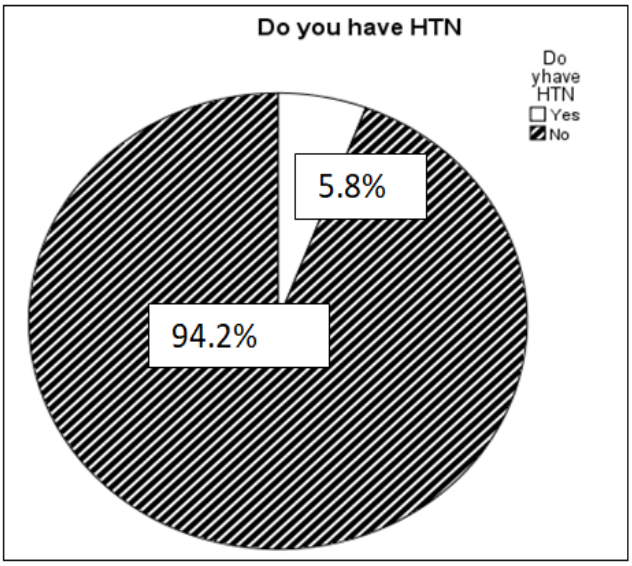

Figure 6: Prevalence of Hypertension in females

There was a statistically significant increase in the mean systolic blood pressure and blood pressure, all by <0.0001, after drinking coffee. There was a significant increase in mean of Mean blood pressure with daily intake of coffee, P-value=<0.0001 as shown in Table 1. This study found that hypertensive subjects have greater response to caffeine with P-value of <0.0001 as shown in the lower table.

Table 1: Shows the participants' average blood pressure before and after drinking coffee

Variables	Mean		P-value
	Before coffee	After coffee	
Blood Pressure (mmHg)	93.4	98.6	<0.0001
Systolic BP (mmHg)	124.2	130.9	<0.0001
Diastolic BP(mmHg)	78.0	82.5	<0.0001
Hypertensive	99.8	119.2	<0.0001
Non- Hypertensive	92.9	98.2	<0.0001
Drink coffee daily	Yes (n=172)	100.4	<0.0001
	No(n=228)	97.3	0.001

P-value consider significant at level <0.05

Figure 7 depicts racial differences in caffeine reaction among the four tribes studied in this study.

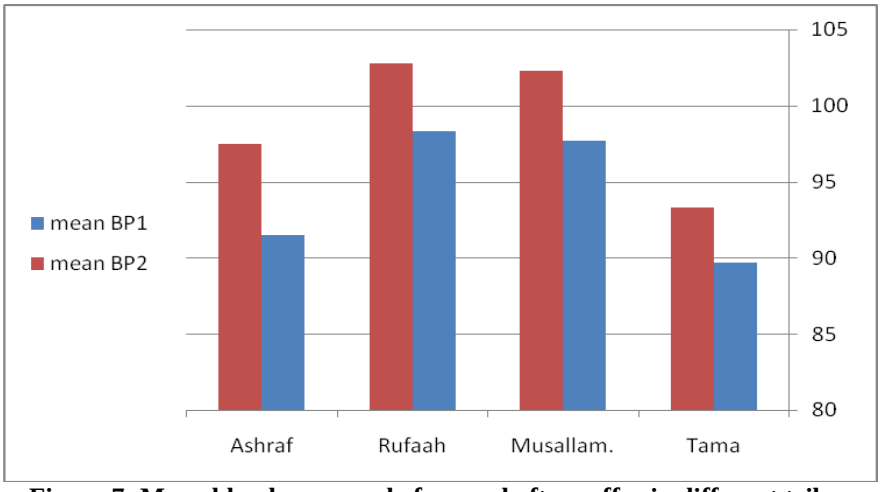

Figure 7: Mean blood pressure before and after coffee in different tribes

In comparison to students and workers, there was a substantial difference in mean blood pressure, with housewives having a higher mean.

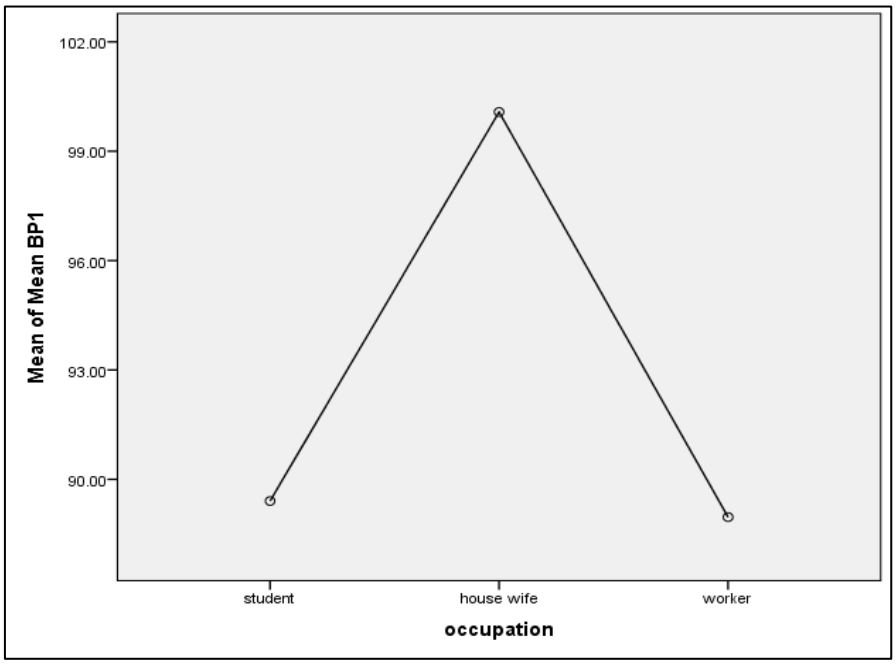

Figure 8: Occupation and Mean Blood Pressure among Female Residents

DISCUSSION

High blood pressure is a significant cardiovascular risk factor that is also linked to organ damage and failure. Caffeine has been linked to an increased risk of hypertension. This study looked at the influence of coffee on blood pressure in Sudanese females living in four communities in the Gezira state's east. After 45 minutes of drinking a 150 ml cup of coffee containing 120 mg of caffeine, the study indicated a statistically significant increase in systolic, diastolic, and mean blood pressure, which was comparable with a study conducted in England by Robertson D *et al.*, 1978. This study showed that caffeine affects people to a greater extent as they get older, which agreed with (Izzo *et al.*, 1983) who found that hypertensive subjects have a greater response to caffeine, but disagreed with it in that there was racial variation in response to caffeine among the four tribes studied. According to occupational classification, the study discovered a substantial variation in mean blood pressure depending on their employment, with housewives having higher mean blood pressure than students and workers. The failure to develop tolerance to the pressure effect of caffeine with daily intake could be attributed to abstinence from caffeine for 12 hours before the test, which agreed with Goldstein *et al.*, 1990, who demonstrated that "Caffeine taken after only an overnight abstinence of 10 ±12 hrs increased blood

pressure in regular coffee drinkers". The prevalence of hypertension was 5.8% in this study. In comparison, Salma Elhadi reported in 2003 that the prevalence of hypertension in Wad Madani city was 8.2 percent. This indicates that hypertension is more prevalent in those four communities than in Al-Gezira State's capital (Madani). According to this study, an increase in body mass index raises mean blood pressure and pulse pressure.

CONCLUSIONS

Caffeine in coffee causes a considerable increase in systolic, diastolic, mean blood pressure, and pulse pressure in older and hypertensive people compared to non-hypertensive people, and there is a racial difference in the presser response to caffeine.

RECOMMENDATIONS

- Reduce caffeine intake in hypertensive individuals for hypertension diet control.
- Decaffeinated coffee should be used by hypertensive patients.
- Coffee drinking is probably safe in people with well-controlled blood pressure, but more research is needed to validate this idea.

ACKNOWLEDGMENT

We would like to express our sincere appreciation thanks to all of the research respondents. We are indebted to the ladies of Elshareefyagoub, Elbugasa, Gaber and Elshabarga villages for collaboration. I feel indebted to anyone who participated and helped me in this work.

REFERENCES

- Arya, L. A., Myers, D. L., & Jackson, N. D. (2000). Dietary caffeine intake and the risk for detrusor instability: a case-control study. *Obstetrics & Gynecology*, *96*(1), 85-89.
- Astrup, A., Breum, L., Toubro, S., Hein, P., & Quaade, F. (1992). The effect and safety of an ephedrine/caffeine compound compared to ephedrine, caffeine and placebo in obese subjects on an energy restricted diet. A double blind trial. *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity*, *16*(4), 269-277.
- Chou, T. M., & Benowitz, N. L. (1994). Caffeine and coffee: effects on health and cardiovascular disease. *Comparative Biochemistry and Physiology Part C: Pharmacology, Toxicology and Endocrinology*, *109*(2), 173-189.
- Dlugosz, L., & Bracken, M. B. (1992). Reproductive effects of caffeine: a review and theoretical analysis. *Epidemiologic reviews*, *14*(1), 83-100.
- Goldstein, I. B., Shapiro, D. A. V. I. D., Hui, K. K., & Yu, J. L. (1990). Blood pressure response to the" second cup of coffee". *Psychosomatic medicine*, *52*(3), 337-345.
- Izzo Jr, J. L., Ghosal, A., Kwong, T., Freeman, R. B., & Jaenike, J. R. (1983). Age and prior caffeine use alter the cardiovascular and adrenomedullary responses to oral caffeine. The American journal of cardiology, 52(7), 769-773.
- James, J. E., & Paull, I. (1985). Caffeine and human reproduction. *Reviews on environmental health*, *5*(2), 151-167.
- Mehta, A., Jain, A. C., Mehta, M. C., & Billie, M. (1997). Caffeine and cardiac arrhythmias. An experimental study in dogs with review of literature. *Acta cardiologica*, *52*(3), 273-283.
- Robertson, D., Frölich, J. C., Carr, R. K., Watson, J. T., Hollifield, J. W., Shand, D. G., & Oates, J. A. (1978). Effects of caffeine on plasma renin activity, catecholamines and blood pressure. *New England Journal of Medicine*, *298*(4), 181-186.
- Salma, E. (2013). Prevalence of hypertension among females in Wad-madani city. University of Gezira.
- Smits, P., Thien, T., & van't Laar, A. (1986). Influence of slow calcium-channel blockade on the cardiovascular effects of coffee. *European journal of clinical pharmacology*, *30*(2), 171-175.
- Stavric, B. (1988). Methylxanthines: toxicity to humans. 2. Caffeine. *Food and chemical toxicology*, *26*(7), 645-662.