

# Normal Blood Pressure in Adult Sudanese in Khartoum State, Sudan

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## ABSTRACT

**Introduction:** The blood pressure and anthropometric measurements are important for evaluating the health of adults, adolescents as well as children. Hypertension is a major risk factor for cardiovascular and cerebro-vascular diseases and can lead to death. Different factors such as age, exercise and body mass index can affect normal blood pressure values.

**Objectives:** To determine the blood pressure among Sudanese population in Khartoum city.

**Methods:** A cross sectional study was done in Khartoum state from September 2016 to November 2018. Four hundred and thirty four healthy adult Sudanese aged 20 to 60 years (87 males and 345 females) were selected from staff, students and employees from Khartoum and Bahri universities. Anthropometric and clinical data were taken. Blood pressure was measured twice by the standard procedure.

**Results:** A total of 434 healthy adults were included, 345 (79.4 %) were females and 89 (20.6%) were males, with age range of 20-60 years. Males have higher mean (SBP) than females ( $120 \pm 8.8$  mmHg ,  $113 \pm 9.7$  mmHg) respectively. And also males have higher (DBP) than females ( $79.3 \pm 5.9$  mmHg,  $74.8 \pm 7.1$  mmHg) respectively. BMI was significantly and positively correlated with both SBP and DBP in all the participant  $P < 0.01$

**Conclusion:** The mean value of blood pressure was similar to international values of blood pressure and there was significant higher blood pressure in males than females. Also there was a positive correlation between BMI, SBP and DBP.

**Key words:** Normal BP value, body mass index, hypertension

## INTRODUCTION

The blood pressure and anthropometric measurements are important for evaluating the health of adults, adolescents as well as children. Hypertension is a major risk factor for cardiovascular and cerebro-vascular diseases. <sup>[1]</sup> Blood pressure is defined as the force of blood pushing against the arterial

walls as blood circulates throughout the body. Blood must circulate at an appropriate pressure in order to sustain life. A healthy adult normally has a blood pressure of 120/80 mmHg (millimeters of mercury) or less. Even though blood pressure varies within an individual, those with a pressure of 140/90mmHg or more for a sustained period of time is said to have high blood

pressure (Hypertensive). A person with high systolic pressure and normal diastolic pressure is classified as hypertensive and the same applies for a person with high diastolic pressure and normal systolic pressure. [2] The association of a high BMI with cardiovascular disease is at least partly explained by the association of BMI with cardiovascular risk factors such as hypertension and elevated serum cholesterol. [3] Many factors affect the normal blood pressure including, advanced age, smoking, black race, low potassium and high sodium intake, inactivity, alcohol intake, stress, some chronic illnesses, overweight and obesity. [4] A study done on Japanese schoolchildren showed that there was significant positive correlation between height, weight and blood pressure, but the correlation between weight and blood pressure was stronger. [5] Overweight and obesity increase the risks of high BP, coronary heart disease, ischemic stroke, type II diabetes mellitus and certain cancers. Worldwide about 58% of cases diabetes mellitus and 21% of ischemic heart disease are attributable to BMI above 21. [6] The overall prevalence of hypertension in Sub-Saharan Africa (SSA) is estimated to be 30%, ranging from 16% at the age of 30 years to 44% at the age of 60. [7] About 74.7 million individuals are currently hypertensive in SSA, and this number is expected to increase to 125.5 million individuals by the year 2025. [8] A study done in four cities of Sudan in Atbara, Shendi, Ed Damer, and Berber showed a prevalence of hypertension of 35.7% and the newly diagnosed cases were 22.4%. Increasing age, low educational level, diabetes mellitus, obesity, and central obesity were found to be risk factors for hypertensions. [9] A study was done in Wad Medani City, Sudan on 1100 subjects to establish reference values for blood pressure for Sudanese, and to compare them with blood pressure values for other populations in other countries. The results showed that: The mean blood pressure for males was to

be  $134 \pm 18/71 \pm 10$ , while the mean blood pressure for females was  $133 \pm 19/73 \pm 9$ . [10]

## METHODS

A cross sectional study was done in Khartoum state from September 2016 to November 2018. 434 healthy adult Sudanese (89 males and 345 females were included) aged 20 to 60 years were included. They were selected from staff, students and employers of two randomly selected governmental universities (Khartoum & Bahri). Subjects with acute illness or systemic diseases that directly or indirectly affect the blood pressure were excluded. Ethical approval was issued from the Federal Ministry of Health. Written consent was obtained from the participants. Personal data and clinical history were taken by a questionnaire. Blood pressure measurements were done by the auscultation method using mercury sphygmomanometers and stethoscopes. Two readings were made 5 minutes apart. If the difference was 10 mmHg or more between the two readings a third reading was obtained. The final reading was the average of the two readings or the nearest two readings if a third was obtained. Body mass index (BMI) was measured by measurement of weight and height then calculation will be conducted by standard procedure for calculation of the (BMI) using weight and height scales. Height will be recorded to the nearest 0.5 cm and weight will be recorded to the nearest 100 g. BMI will be calculated as weight in kilograms over height in squared meters.

The obtained data will be analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 and will be presented in table and graphs.

## RESULTS

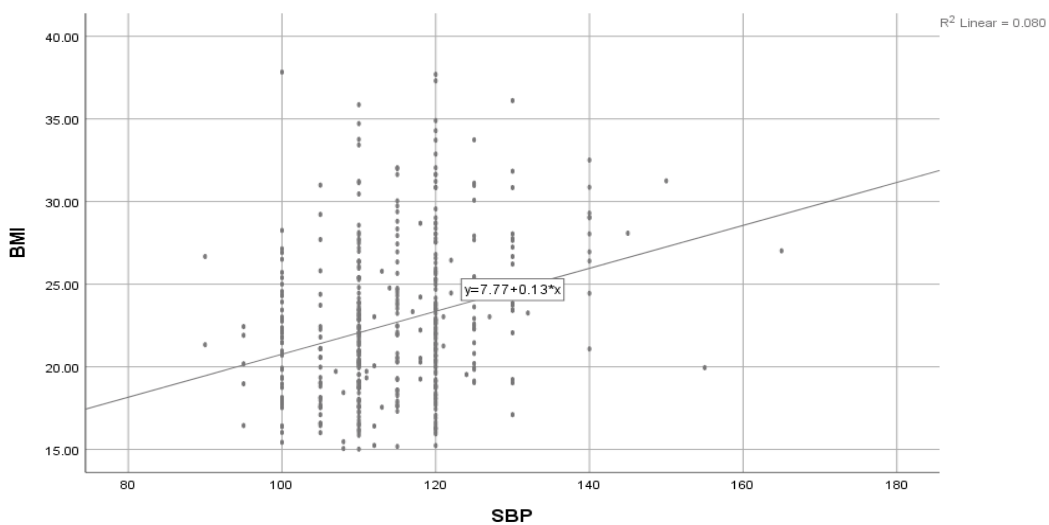
A total of 434 healthy adults were included, 345 (79.4 %) were females and 89 (20.6%) were males, with age range of 20-60 years. The mean for systolic blood pressure was ( $114.4 \pm 9.9$  mmHg) while diastolic blood pressure was ( $75.7 \pm 7.1$

mmHg). Both results were found to be the same as international. There was slight gender variation that males have higher systolic and diastolic blood pressures than females ( $120 \pm 8.8 / 79.3 \pm 5.9$  mmHg ,  $113 \pm 9.7 / 74.8 \pm 7.1$  mmHg) respectively. BMI was significantly and positively correlated with both SBP and DBP in all participants ( $P < 0.01$ ) (figures 1 and 2). BMI showed no significant gender variation ( $P = 0.41$ ), as shown in table-1. Systolic and diastolic blood pressures significantly increase with BMI groups in ( figure-3).

**Table (1): Correlation between BMI, SBP and DBP in Sudanese males and females.**

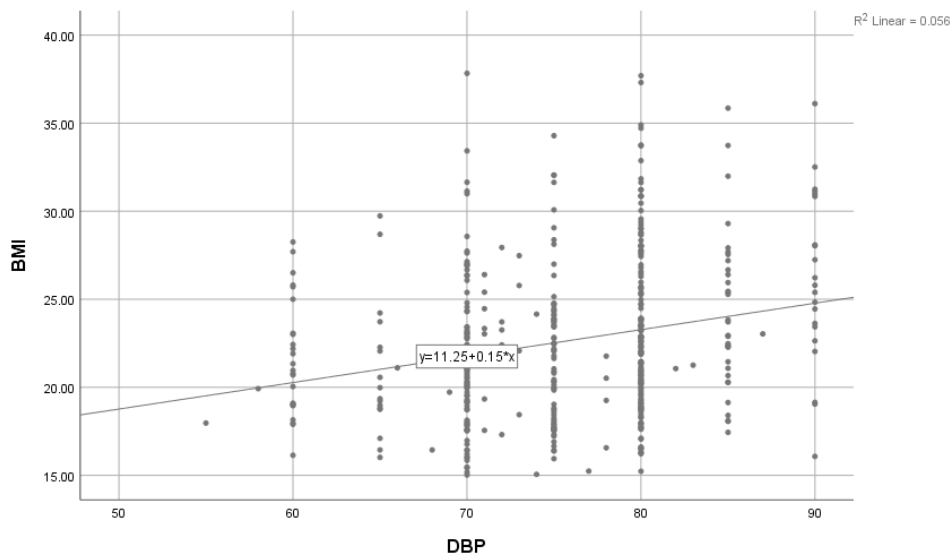
Differences	Male	Female	P-value
Mean SBP±SD	120.0 ± 8.8	113.0 ± 9.7	0.00
Mean DBP±SD	79.3 ± 5.9	74.8 ± 7.1	0.00
Mean BMI±SD	22.3 ±4.6	22.7 ±4.6	0.41

In table-1, both SBP and DBP were significantly higher in males than females ( $P = 0.000$ ). There was no significant correlation between BMI and gender ( $P = 0.41$ ).



**Figure (1): Correlation between BMI and SBP**

In figure-1, there was significant positive correlation between BMI and SBP ( $r^2 = 0.08$  and  $P = 0.0$ ).



**Figure (2): Correlation between DBP and BMI**

In figure-2 there was significant positive correlation between BMI and DBP ( $r^2 = 0.06$  and  $P = 0.00$ ).

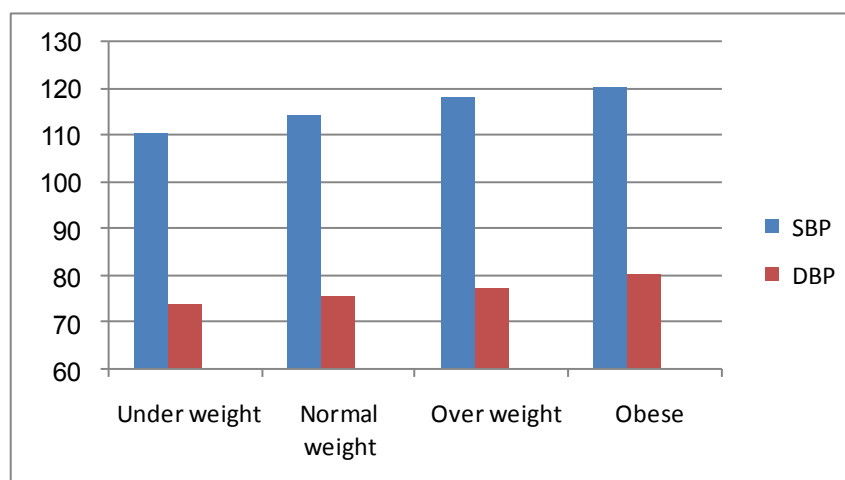


Figure (3): Correlation between SBP, DBP and BMI groups.

## DISCUSSION

In our study the normal blood pressure values of Sudanese were similar to the international values of blood pressure. [11] Our results showed strong correlation between BMI and SBP or DBP in male and female participants. Although females had higher BMI than males, but males had higher BP and it may be due to low physical activities and less smoking habit in Sudanese females. Our results were supported by Tassaduq et. al, who found that the increased prevalence of hypertension was with advancing age, [Error! Reference source not found.] while, Humayun et al. had indicated a strong association of hypertension to BMI rather than age. [13] Tesfaye et. al conducted study in Asia and Africa in 2006. He found that SBP and DBP were positively correlated with age while BMI was not or was negatively correlated in some cases. [14] In the present study, prevalence of high blood pressure was greater in those with high BMI, which was also reported by other studies. [15,15] Doll et al. explained obesity-associated high blood pressure as an inadequate vasodilatation in the presence of increased blood volume and cardiac output, which are natural consequences of an increased mass. [17]

## CONCLUSION

In Sudanese (Khartoum), the mean systolic blood pressure was ( $114.4 \pm 9.9$  mmHg) while diastolic blood pressure was ( $75.7 \pm 7.1$  mmHg). Both results were found to be the same as international. Males have higher blood pressure values than females with positive correlation between body mass index and blood pressure values.

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