The National Ribat University

Faculty of Graduate Studies and Scientific Research

To evaluate the relationship between the body mass index and blood pressure levels among Sudanese adults in Khartoum state in 2016

A thesis submitted in partial Fulfillment of the requirements of the master degree in human Physiology

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Supervised by: Professor Omer Abdelaziz

Dedication

I would like to express my very profound gratitude to my parents, my spouse, my sister and my wonderful children for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them.

Thank you

Acknowledgment

I would first like to thank my thesis advisor professor Omer Abdelaziz for having a door always open whenever I had a question about my research or writing. He consistently allowed this paper to be my own work, and steered me in the right direction whenever he thought I needed it.

I would also thank the people who were involved in the validation of the survey for this research project. Without their passionate participation and input this thesis could not have been successfully conducted.

Abstract

Introduction: Normal blood pressure reference values and its relation to the body mass index are not well defined in Sudan. The current reference values were obtained from international guidelines of western countries.

Objectives: To document the normal values of blood pressure in healthy Sudanese adults in Khartoum and its relation to the body mass index. Overweight and obesity increase the risk of elevated blood pressure, but the knowledge of the effect of weight change on blood pressure is not widespread. The guidelines of hypertension diagnosis and management do not take into account the BMI.

Methods: A cross sectional study was gathered during 2016 in Khartoum state on adult males and adult females between ages 20-60 years who were not known to be hypertensive. 200 participants were given a questionnaire which covered gender, age, physical activity, daily salt intake, and history of smoking. The BMI was calculated using the formula weight(kg)/height(m)2.The systolic and diastolic blood pressures were measured using a manual mercury sphygmomanometer.

Results: this study was performed in Sudanese males (n128) and females(n72) aged 20-60 years old. Age groups from 30-39 years old were among the highest participated from both genders. From the 200 individuals 35.8% were considered overweight while only 19% obese.There is a linear correlation between the increment of diastolic blood pressure, which is statistically significant (p=0.023); also a stronger linear correlation between the increment of BMI and that of systolic blood pressure, which is statistically significant (p=0.002)

ملخص الدراسة

الاهداف:

صممت هذه الدراسة لتحديد ضغط الدم الطبيعي وتوثيق القيم الطبيعية لضغط الدم وعلاقته بمؤشر كتله الجسم.

زيادة الوزن والسمنة تزيد من خطر ارتفاع ضغط الدم, المبادئ التوجيهية لتشخيص ضغط الدم لا تأخذ في اعتبار مؤشر كتله الجسم.

النتائج:

أجريت دراسة مقطعيه خلال عام 2016 في ولاية الخرطوم على الذكور البالغين والإناث البالغات بين الاعمار20-60 سنه اللذين لم يعرف لديهم ارتفاع في ضغط الدم

أجريت هذه الدراسة في 128 من الذكور و 72 من الإناث.

كانت الفئة العمرية من بين 30-39 سنه من بين اعلي الفئات المشتركة في البحث من الجنسين,

من 200 شخص 35.8% اعتبرت زيادة الوزن في حين إن 19% فقط يعانون من السمنة المفرطة.

هنالك علاقة خطيه بين زيادة الضغط الانبساطي وهي ذات دلاله إحصائية

(p=0.023)

أيضا هنالك علاقة خطيه بين زيادة ضغط الانقباضي ومؤشر كتلة الجسم

وهي ذات دلاله إحصائية (p=0.002)

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List of abbreviations

BMI	Body mass index
BP	Blood pressure
HDL-C	High density lipoprotien
WHO	Word health organization
MAP	Mean arterial blood pressure
CO	Cardiac output
SVR	Systemic vascular resistance
BIA	Bioelectric impedance analysis
NHANES	National health and nutrition examination survey

Article Review:

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Abstract:

Background:

Overweight and obesity increase the risk of elevated blood pressure, but the knowledge of the effect of weight change on blood pressure is not widespread. A number of studies were directed to document a relationship between the BMI and the blood pressure.

Methods: An expansive search using trusted internet sites was conducted to find researches that are concerned with the relation of BMI and the blood pressure. The key words (blood pressure, body mass index) covering the period from 1984-2015.

Results: more than 20 papers have been presented and 6 have been reviewed. Studies show a great prevelance of high blood pressure has increased significantly in relation to increased body weight amongst various adults and adolescents around the world.

Conclusion: most of the studies had the BMI as a major influencing factor in increasing the blood pressure.

To evaluate the relationship between body mass index and blood pressure levels among Sudanese adults in Khartoum state, 2016

Introduction: There are not any recognized studies directed to Sudanese Adults and adolescence that display any relationship between blood pressure and the body mass index. Refrences used in diagnosis and management are internationally obtained. The normal values of blood pressure in healthy Sudanese Adults living in Khartoum is the objective of this study.

Methods:extensive research through trusted internet sites were directed concerning researches related body mass index to blood pressure.

Key words used: Body mass index and the blood pressure

Results: six papers reviewed have showing an obvious correlation between blood pressure and the body mass index([1,2,3,4,6]).on the other hand another study done by Nadia Danon showed a decline in blood pressure with BMI over time[(5)].

STUDY NUMBER (1)

AUTHOR	YEAR/ STUDY TYPE	SAMPLE SIZE	RESULTS AND CONCLUSIONS
Suman Dua(1)	2014 A cross-sectional study	Punjabi community, residing in Roshanara area and Jaina building in Delhi, for the past 20 years and aged 18-50 years. A total of 117 males and 123 females. The men were engaged in transport business and women were mainly housewives.	**Results**: There was a significant positive correlation between BMI, fat percentage, and blood pressure both SBP as well as DBP. Odds ratio showed that overweight/obese subjects were more likely to have hypertension than those with normal BMI. **Conclusion**:Prevalence of prehypertension among overweight/obese suggested an early clinical detection of prehypertension and intervention including life style modification, particularly weight management.

STUDY NUMBER (2)

AUTHOR	YEAR/TYPE OF STUDY	SAMPLE SIZE	RESULTS AND CONCLUSIONS
F. Tesfayl(2)	cross-sectional descriptive design in Ethiopia, Vietnam and Indonesia, 2007	7675	**Results:**BMI and BP increased along the socioeconomic gradient across the three countries. A high prevalence of overweight/obesity was noted among

			Indonesian women (25%) and men (10%), whereas low BMI was widely prevalent in Ethiopia and Vietnam, ranging from 33 to 43%. **Conclusion**: BMI was significantly and positively correlated with both SBP and DBP in all the three populations, correlation coefficient (r) ranging between 0.23 and 0.27, Po0.01. High BP exists in a background of undernutrition in populations at early stages of the epidemiologic transition.

STUDY NUMBER (3)

AUTHOR	YEAR/TYPE OF STUDY	SAMPLE SIZE	RESULTS AND CONCLUSIONS
W.B Droyvold(3)	cross-sectional studies one in 1984–86 and the other in 1995–97. Norway	included **15 971**WOMEN and **13 846** men who were 20 y or older at the first survey, without blood pressure medication at both surveys and without diabetes, cardiovascular disease or dysfunction in daily life at baseline.	**Results**:An increase in BMI and a decrease in BMI were significantly associated with increased and decreased SBP and DBP, respectively, compared to a stable BMI in both genders and all age groups, although the strongest effect was found among those who were 50 y and older. **Conclusion:**result supports an

			independent effect of change in BMI on change in SBP and DBP in both women and men, and that people who increase their BMI are at increased risk for hypertension.

STUDY NUMBER(4)

AUTHOR	YEAR/STUDY TYPE	SAMPLE SIZE	RESULTS AND CONCLUSIONS
Ichiro Wakabayash(4)	A community-based cross-sectional study .	157,902 workers in Yamagata, Japan.	**Results:** BMI showed significant positive correlations with systolic and diastolic blood pressures. The relationships of BMI with systolic and diastolic blood pressures became weaker with advancing age in both men and women after 30 and 40 years of age, respectively. **Conclusion:** The relationships of obesity with blood pressure, serum total cholesterol level and atherogenic index in the elderly are much weaker than in the young.

STUDY NUMBER (5)

AUTHOR	YEAR/STUDY TYPE	SAMPLE SIZE	RESULTS AND CONCLUSIONS
Nadia Danon(5)	Two independent cross-sectional examination surveys were conducted in 1989	1989 (n 1081) and in 2004 (n 1255) age 25–64 years.	**Results**:Between 1989 and 2004, mean BP (mm Hg) decreased slightly (from 133/87 to 131/86 in men and from 127/82 to 124/81 in women), with little change in the age-standardized prevalence of high BP (BP 140/90 or current treatment; from 45% to 44% in men and from 34% to 36% in women). During this same time period, there were marked increases in awareness (from 42% to 64%), treatment (22% to 59%), and control (3% to 20%) among participants with high BP. The prevalence of overweight (BMI 25 kg/m2) increased from 39% to 60%. Furthermore, the linear relationship between BMI and BP was markedly weaker in 2004 than in 1989, irrespective of antihypertensive treatment and age, and among both lean and overweight participants. Among untreated persons, a

			BMI increment of 1 kg/m2 was associated with an elevation of 2.0/1.5 mm Hg of systolic/diastolic BP in 1989 but only 1.3/1.0 mm Hg in 2004. **Conclusions:** The association between BMI and BP has decreased over time. Further study is needed to understand the reasons for the decline in this association, and what the implications are in the context of the obesity epidemic.

STUDY NUMBER (6)

AUTHOR(S)	YEAR/ TYPE OF STUDY	SAMPLE SIZE	RESULTS AND CONCLUSIONS
Varshita A(6)	2015	100 students	**Results:-** average age of the subjects was 18.3± 0.690. In females, the mean systolic and diastolic blood pressure was 120.05±4.918 and 70.68±6.646. The mean BMI in females was 21.1884±3.53. In males, the mean BMI was 22.85±3.2. the mean systolic and diastolic blood pressure in males was 123.24±6.60 and 73.92±8.336. When

			an independent T test was done between males and females the value was found to be 2.088 for BMI (p=0.039), 2.565 for systolic (p=0.012), 1.977 for diastolic blood pressure (P=0.051). The p value of BMI, systolic and diastolic blood pressure is less than 0.05, it is considered to be statistically significant. The BMI was found to be within the normal range (18.5-25) for most of the subjects. 13% of the subjects were underweight (BMI<18). 18% of the subjects were overweight (BMI= 25-29.9) out of which 3% were obese (BMI>29.9). Most of the blood pressure was considered most of the subjects were normotensive. The subjects were considered as hypertensive when the systolic blood pressure is greater than 140 and diastolic blood pressure was greater than 90. About 5% of the subjects were hypertensive. Conclusion:

			There is positive correlation between systolic, diastolic blood pressure and BMI. Increased Blood pressure was seen in subjects with higher BMI when compared with subjects with lower BMI.

Discussion: all preceding studied display a positive correlation between an increased BMI and the systolic and diastolic blood pressure[1,2,3,4,6] . Regardless of one study showing a decrease of BMI and blood pressure levels over time[5] A larger scale study is needed to find the normal blood pressure according to BMI.

Conclusion: there is increased risk of hypertension among overweight/obese individuals with international existing guidelines. The effect of BMI and BP needs further studies.

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INTRODUCTION

Hypertension places an excessive financial burden on populations and health systems, consuming scarce resources. Population-based preventive approaches are, thus, important for the management of elevated BP in developing countries.

The guidelines of hypertension diagnosis and management do not take into account the BMI.

OBJECTIVES:

General objective:

To evaluate the relationship of overweight and obesity with blood pressure levels among Sudanese adults in Khartoum state during the period of May-August 2016.

Specific objectives:

1. Measure the BP in apparently normal Sudanese subjects.
2. Determine the BMI in them.
3. Workout classification of prehypertension, hypertension, overweight and obesity in them.
4. Determine the prevalence of hypertension and obesity in Sudanese accordingly.
5. Correlate the BMI and Blood pressure.

To evaluate the relationship between body mass index

and blood pressure levels among Sudanese adults in Khartoum state, 2016

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Methods: A cross sectional study was conducted during 2016 in Khartoum state on adult males and adult females between ages 20-60 years who were not known to be hypertensive. 200 participants were given a questionnaire which covered gender, age, physical activity, daily salt intake, and history of smoking. The BMI was calculated using the formula weight(kg)/height(m)2.The systolic and diastolic blood pressures were measured using a manual mercury sphygmomanometer.

Results: this study was performed in Sudanese males (n128) and females(n72) aged 20-60 years old. Age groups from 30-39 years old were among the highest participated from both genders. From the 200 individuals 35.8% were considered overweight while only 19% obese.

There is a linear correlation between the increment of diastolic blood pressure, which is statistically significant (p=0.023); also a stronger linear correlation between the increment of BMI and that of systolic blood pressure, which is statistically significant (p=0.002)

Conclusion: from the observation of this study, there is positive correlation between the BMI and the systolic and diastolic blood pressures thus indication blood pressure and BMI are 2 important variables to relate to when considering high blood pressure levels.

Literature review:

Despite a growing burden of obesity and hypertension in developing countries, there is limited information on the contribution of body mass index (BMI) to blood pressure (BP) in these populations. Globally, high blood pressure (BP) is estimated to cause 7.1 million deaths, about 13% of the total. About 62% of cerebrovascular disease and 49% of ischemic heart disease are attributable to high BP.

The body mass index (BMI) is independently and positively associated with increased mortality and morbidity from high blood pressure . (In Caucasian populations, a strong association has been found between BMI and mortality.) There has been a long relationship between BMI and BP it has also been the subject of epidemiological research. This relationship, however, is not sufficiently explored among the populations in Africa. Some studies have documented a consistent association between BMI and BP.[(1)]

Other studies that have examined the relationship between body weight and cardiovascular mortality have also reported a curvilinear relationship with increased risk of mortality among the very lean and very overweight.

Prevalence of overweight and obesity is increasing worldwide, and overweight and obesity are associated with elevation in the blood pressure. Further, studies have shown a progressive increase in blood pressure with ageing in developed countries. This effect begins in childhood and continues into adulthood and may be caused by weight gaining by age.The exact underlying pathophysiological mechanisms between change in BMI and blood pressure are still not that clear. What is known is that weight gain stimulates sympathetic function, and also that probably insulin and leptin are involved. Also, activation of the renin–angiotensin system as well as physical compression of the kidney may be important factors in associating body weight and elevated blood pressure.[(3)]

Unlike the prevalence of diabetes, which has elevated over time in parallel with obesity, mean BP and the prevalence of hypertension have decreased in many developed countries.(Part of the decrease in mean BP over time may relate to larger proportions of hypertensive persons under treatment. Nevertheless, a study assessing BP trends in the 38 populations of the WHO MONICA project between the mid 1980s and the mid 1990s showed a decrease in mean BP in the entire distribution of BP readings, suggesting that much of the decrease was not attributable to antihypertensive medication.) The causes of this clear BP decline over time in these populations remain largely unexplained. One possible

explanation for the diverging trends in the frequency of obesity and hypertension is that the association between body mass index (BMI) and BP might have changed over time.[12]

Classification of blood pressure adopted by the American Heart Association for adults who are 18 years and older assumes the values are a result of averaging resting blood pressure readings measured at two or more visits to the doctor. They are classified according to the categories of systolic BP and the diastolic Bp. (Desired blood pressure was classified as 90mmhg- 119mmhg systolic and a 60- 79 diastolic while prehypertension a 120mmhg- 139mmhg systolic and a 80-89mmhg diastolic.)

Blood pressure changes from minute to minute and normally shows a circadian rhythm over a 24-hour period, with highest readings in the early morning and evenings and lowest readings at night. Loss of the normal fall in blood pressure at night is associated with a greater future risk of cardiovascular disease and there is evidence that blood pressure reading at night is a stronger predictor of cardiovascular events than day-time blood pressure.[4]

As adults age, the systolic pressure tends to rise and the diastolic tends to fall.. Also, an individual's blood pressure varies with exercise, emotional reactions, sleep, digestion and time of day (circadian rhythm).[5]

Some clinical trials demonstrate that people who maintain arterial pressures at the low end of these pressure ranges have much better long term cardiovascular health. The principal medical debate concerns the aggressiveness and relative value of methods used to lower pressures into this range for those who do not maintain such pressure on their own.

The mean arterial pressure (MAP) is the average over a cardiac cycle and it is determined by the cardiac output (CO), systemic vascular resistance (SVR), and central venous pressure (CVP).

Normal change in blood pressure is adaptive and necessary. Fluctuations in pressure that are significantly greater than the norm are associated with greater white matter hyper intensity, a finding consistent with reduced local cerebral blood flow and a heightened risk of cerebrovascular disease. (Within both high and low blood pressure groups, a greater degree of fluctuation was found to correlate with an increase in cerebrovascular disease compared to those with less variability, suggesting the consideration of the clinical management of blood pressure fluctuations, even among normotensive older adults.) Older individuals and those who had received blood pressure medications were more likely to exhibit larger fluctuations in pressure.

During each heartbeat, blood pressure varies between a maximum (systolic) and a minimum (diastolic) pressure. The blood pressure in the circulation is principally due to the pumping action of the heart. Differences in mean blood pressure are responsible for

blood flow from one location to another in the circulation. Rate of mean blood flow depends on both blood pressure and the resistance to flow presented by the blood vessels.[6]

Most influences on blood pressure can be understood in terms of their effect on cardiac output and resistance (the determinants of mean arterial pressure).

Some factors are the blood volume, cardiac output, systemic vascular resistance, viscosity and the presence of an arterial stenosis (a narrow stenosis increases resistance to flow, however this increase in resistance rarely if ever increases systemic blood pressure, it decreases downstream flow). In practice, each individual's autonomic nervous system and other systems regulating blood pressure respond to and regulate all these factors so that, although the above issues are important, they rarely act in isolation and the actual arterial pressure response of a given individual can vary widely in the short and long-term.[7]

. Body fat is measured through various methods (skinfolds, waist-to-hip ratio, bioelectrical impedance analysis (BIA), etc.), but the most commonly used measure is body mass index, BMI= wt. (kg)/height (m^2).

The relationship between the level of blood pressure and BMI has been perceived to be linear and strong .The definition of elevated blood pressure (hypertension) has evolved over time.. Factors that are known to elevate pressure, including body mass, age, diet, and family history.

(The basis of the BMI was devised by Adolphe Quetelet from 1830 to 1850 during which time he developed what he called "social physics". The modern term "body mass index" (BMI) for the ratio of human body weight to squared height was coined in a paper published in the July 1972 edition of the Journal of Chronic Diseases by Ancel Keys. In this paper, Keys argued that what he termed the BMI was "...if not fully satisfactory, at least as good as any other relative weight index as an indicator of relative obesity.)[9]

The interest in an index that measures body fat came with increasing obesity in Western societies. BMI was explicitly cited by Keys as appropriate for population studies and inappropriate for individual evaluation. Nevertheless, due to its simplicity, it has come to be widely used for preliminary diagnosis. Additional metrics, such as waist circumference, can be more useful.

BMI is proportional to mass and inversely proportional to the square of the height. So, if all body dimensions double, and mass scales naturally with the cube of the height, then BMI doubles instead of remaining the same. This results in taller people having a reported BMI that is uncharacteristically high, compared to their actual body fat levels. In comparison, the Ponderal index is based on the natural scaling of mass with the third power of the height.

(The WHO regards a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI equal to or greater than 25 is considered overweight and above 30 is considered obese.)[10]

(A recent report described associations between overweight and obesity and the prevalence of chronic conditions including high blood pressure and high blood cholesterol levels in National Health and Nutrition Examination Survey (NHANES) III data. Associations between obesity and high blood pressure, high blood cholesterol, and low levels of high density lipoprotein-cholesterol (HDL-C) have been shown in men and women and in diverse race/ethnic groups.)

The prevalence of overweight and obesity is increasing, and obesity is now estimated to be the second leading cause of preventable death after cigarette smoking in the United States.

Although the terms overweight and obesity are often used interchangeably, overweight refers to an excess of body weight compared with height; obesity refers to an excess of body fat. In populations in which high levels of adiposity are common, such as the population of the United States, excess body fat or adiposity is highly correlated with body weight.[12]

Materials and methodology:

A cross-sectional study was performed on Sudanese population in Khartoum state the capital of the Sudan by a visit to governmental institutions (the national parliament of Sudan). A sample size of 200 participants 128 males and 72 females aged 20-60 years were not known to be hypertensive or afflicted by any other chronic disease. Random samples were obtained following written consent. Questionnaires were conducted containing the following information:- age, gender, hypertension, chronic disease, physical activity, salt intake and smoking. The blood pressure was measured by a manual mercury sphygmomanometer. Height and weight were measured using standard scales. The BMI was calculated using the formula: weight(kg)/height(m)^2.Date was analyzed and collected using SPSS(statistical package for social sciences), Pearson correlation was applied and the P value of <0.05 was considered statistically significant.

Results:

This study was performed in Sudanese males (n128) and females (n72) aged 20-60 year old. Age groups from 30-39 years old were among the highest participated from both genders. From the 200 individuals 35.8% were considered overweight while only 19% obese (figure no.1)

With regards to the systolic pressure 54% of participated were considered prehypertensive while 39% had a diastolic prehypertention (figure no. 3,2)

In the diastolic pressure of 200 individuals just 22% were considered hypertensive (figure no.2). the diastolic (<89mmhg) hypertensive values were found in 41 individuals(figure no.2); while a hypertensive systolic reading (>139mmhg) was found only in 29 individuals (figure no.3)

According to the systolic and diastolic pressures prevalence of prehypertension was more in males than females; this difference is minor(tables no.7 and 8)

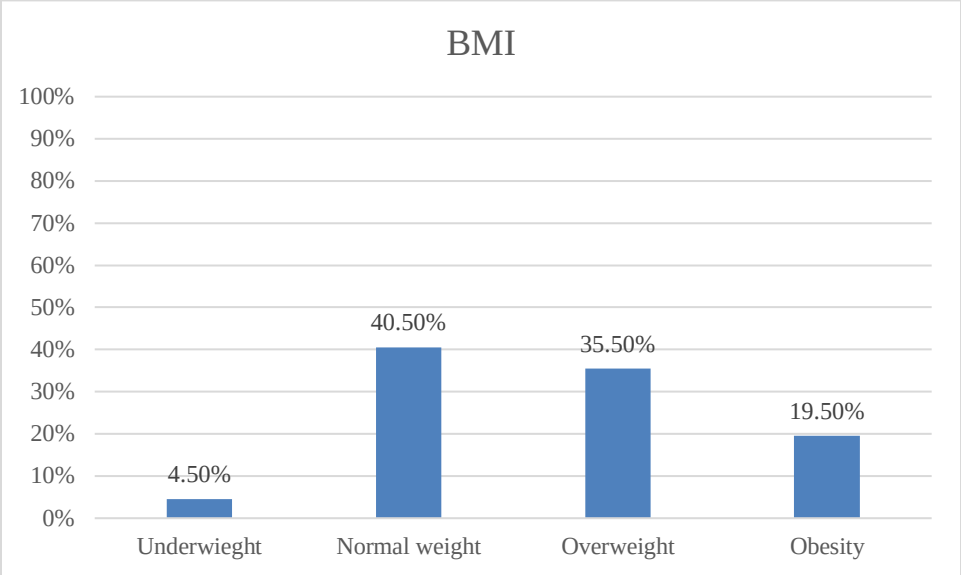
About 55% males show prehypertensive systolic values, while just 15%hypertensive values(table no. 4) on the other hand female diastolic blood pressure with 21% prehypertensive and 14% hypertensive(table no.3)

obese participants were more males than females (tables no. 1 and 2) but females had a higher mean BMI than males (table no.1)

About 82% of participants with high BMI(obese and overweight) values had a hypertensive systolic value(tableno.5) out of 200 participants 63% having a BMI(obese and overweight) values have a hypertensive diastolic value(table. No.5) there is a linear correlation between the increment of diastolic blood pressure, which is statistically significant($p=0.023$); also a stronger linear correlation between the increment of BMI and of that of systolic blood pressure, which is statistically significant($p=0.002$)(figures 3 and 4)

Using statistical analysis program SPSS):-

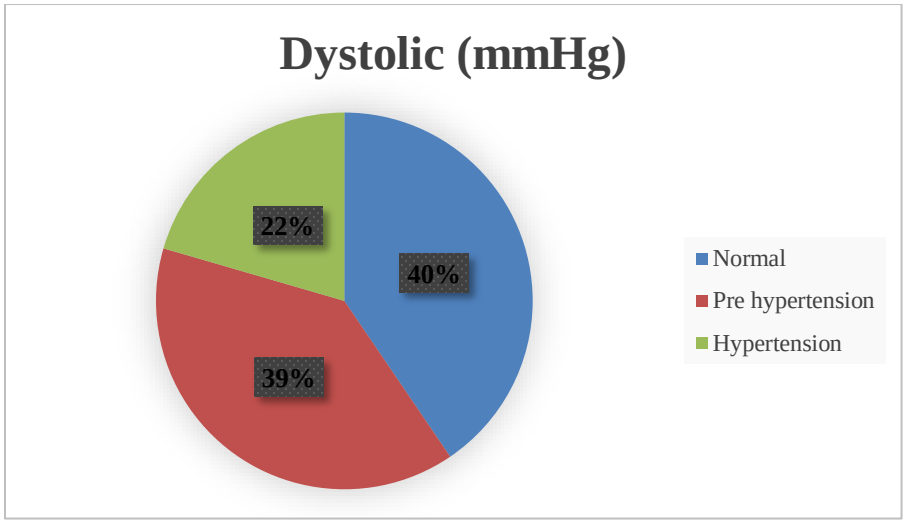
Figure (1):- This is a bar chart showing distribution of the BMI in percentages. With highest percentage to the normal weight category (40.50%) and lowest percentage to the underweight category (4.50%)



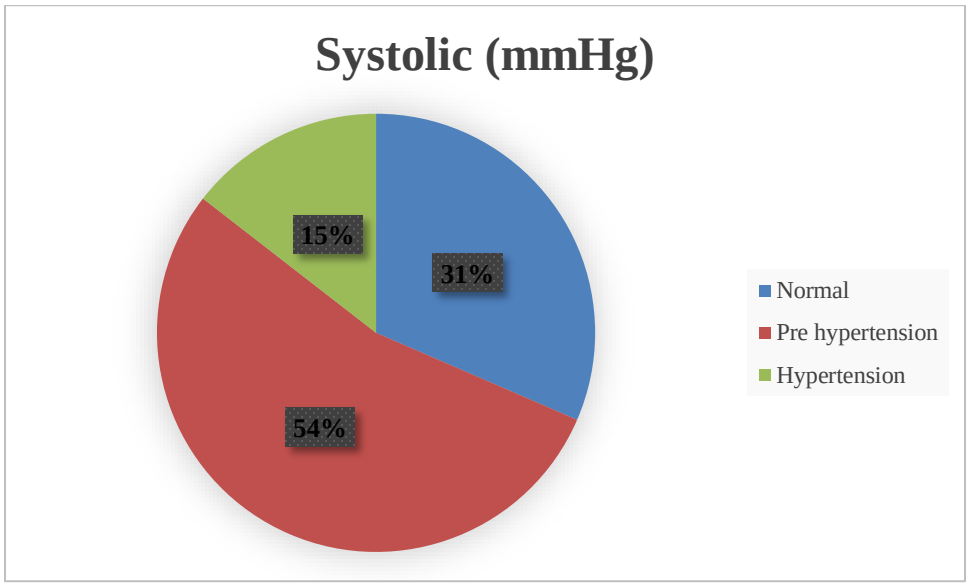
- Table(1):- the table shows the **mean** by **gender** concerning (systolic, diastolic and BMI mean values)

Item	**Males**	**Females**
Systolic (mmhg)	**123+/-**	**122+/-**
Diastolic (mmhg)	**81+/-**	**77+/-**
BMI	**25.8+/-**	**26.5+/-**

- Figure (2):-**Diastolic** values in 200 participants(41% normal, 39% prehypertensive, 22% hypertensive)



- Figure (3):-**Systolic** values in 200 participants (31% normal, 54% prehypertensive,15% hypertensive.



- Table(2):- Relationship between **males and females** and the **BMI**:-

Variables/BMI	**Males (% from total males 128)**
Underweight	**5%**
Normal weight	**44%**
Overweight	**31%**
Obesity	**20%**
	Females(%from total females 72)
underweight	**2%**
Normal weight	**20%**
overweight	**24%**
obesity	**11%**

- Table (3):- the **systolic**pressure in relation to **males** and **females**.

The Systolic BP	**Males (% out of 128)**
normal	**30%**
Prehypertension	**55%**
hypertension	**15%**
	Females(% out of 72)
normal	**35%**
prehypertension	**51%**
hypertension	**14%**

- Table (4):- the **diastolic** pressure in relation to **males** and **females.**

Diastolic BP	**Males (%out of 128)**
normal	**32%**
prehypertention	**45%**
hypertension	**23%**
	Females(%out of 72)
normal	**55%**
prehypertension	**28%**
hypertension	**17%**

Table (5):- showing percentage of individual(males and females)s with high BMI (overweight and obese) and **hypertensive diastolic** blood pressure.

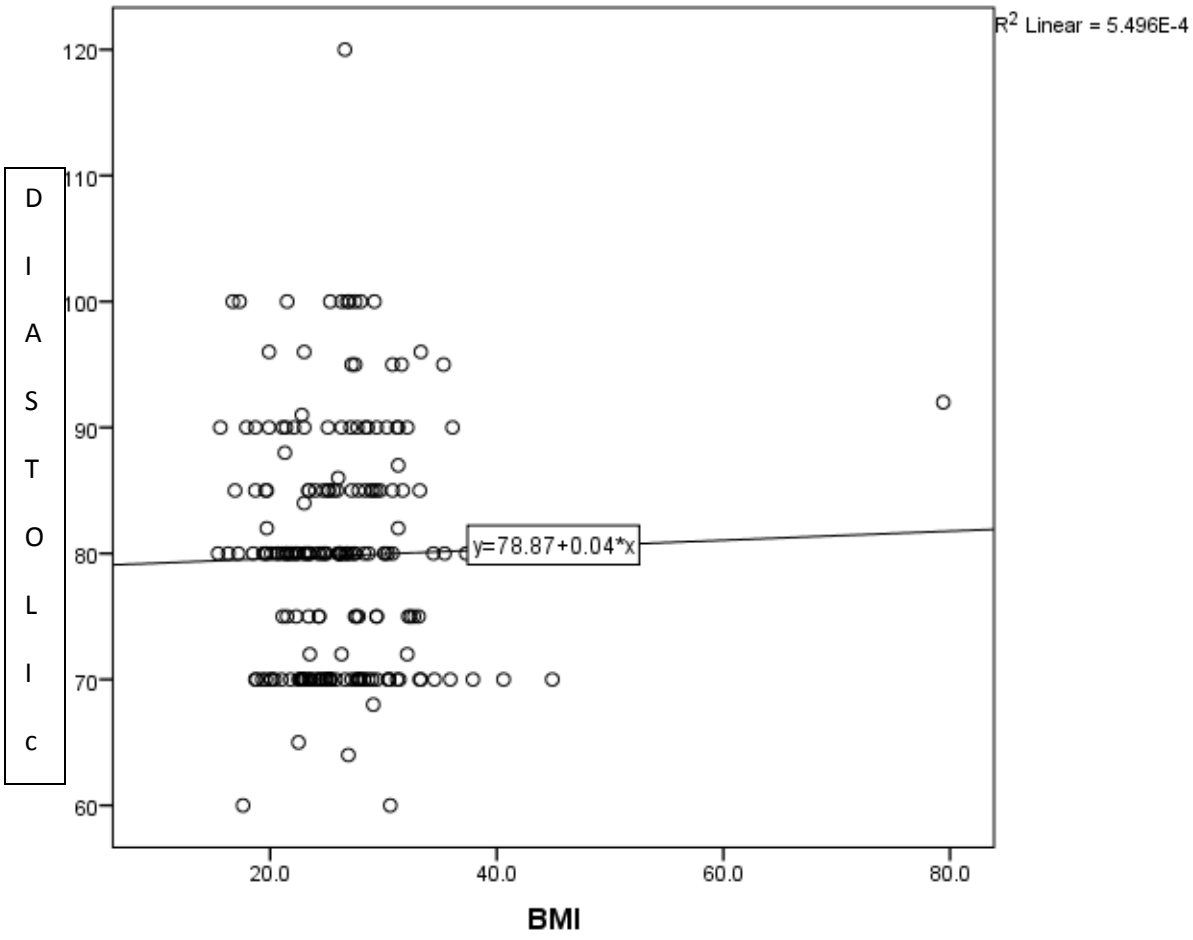
BMI	Number(out of 31)	percentage
overweight	**17**	**55%**
obese	**9**	**29%**

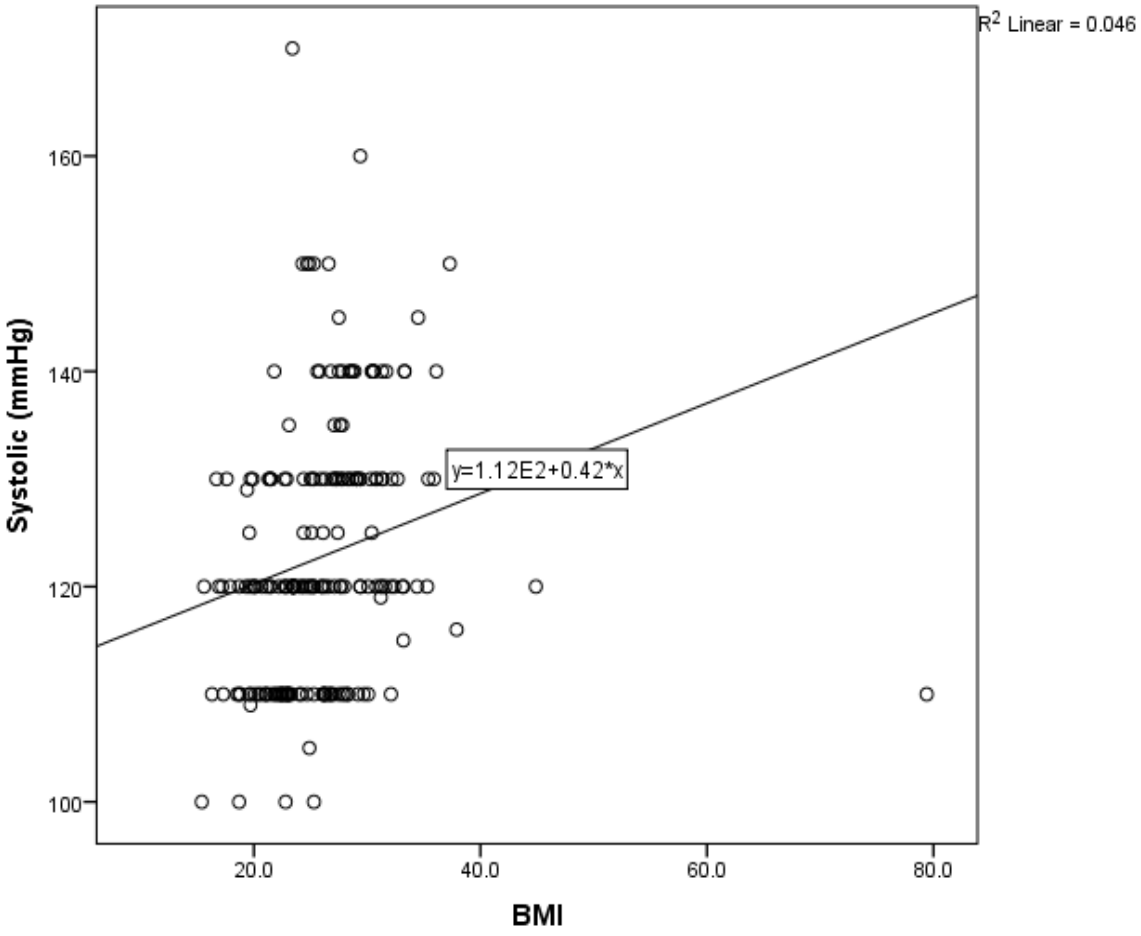
Table(6):- showing percentage of individuals(males and females) with high BMI (overweight and obese) and **hypertensive systolic** blood pressure.

BMI	Number(out of 29)	percentage

overweight	**13**	**45%**
obese	**11**	**38%**

- Figure (3)(line graph):-showing linear relationship between **diastole with BMI**.


R2 Linear = 5.496E-4
DIASTOLIc
mmhg
120
110
100
90
80
70
60
y=78.87+0.04*x
20.0
40.0
60.0
80.0
BMI



- Figure (4)(line graph above):- showing linear relationship between **systole and BMI.**

Discussion

Hypertension is the most common contributor to cardiovascular mortality. Prevalence and significance of the correlation between BMI and high blood pressure has been well documented (articles no.1,2,and 8). Obesity alone is not a well predictor of increased blood pressure other factors have to be put into consideration such as age, physical activity, bone density, dietary habits etc.

This study was performed to obtain the true relationship between the BMI and blood pressure in Sudanese adults and adolescents. Also this study demonstrates a linear relationship between systolic and diastolic values and the BMI (fig.3 and 4). While its noteworthy to clarify why men had more BMI than females is worth more investigation(table no. 6) either use of more anthropometric measurements such as skin fold, waist circumference, muscle mass etc. must be put into consideration.

The most important finding in this study is the strong relationship between the increase in BMI and the systolic blood pressure as compared to the diastolic BP which is much weaker. The question arises is why is systolic more affected by BMI than diastolic.

If the BP increases with increased BMI then the normal values and the classification of hypertension may need another definition. This needs a very big study to derive equations showing the normal BP according to BMI.

Conclusion

Several studies have shown that there is a significant relationship between relative weight gain and hypertension. Prevention of weight gain should be the primary therapeutic target in reducing hypertension.

From the observation of this study, there is positive correlation between the BMI and systolic and diastolic blood pressures thus indicating blood pressure and BMI are two very important variable to relate to when considering high blood pressure levels. More awareness and documentation should be thought through concerning this issue.

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