



Prevalence of Hypertension Stages and the Main Risk Factors in Khartoum Locality, Sudan, 2014

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Authors' contributions

This work was carried out in collaboration between all authors. Author AAA designed the study, wrote the protocol, managed the literature searches and wrote the first draft of the manuscript. Author NAWF revised the questionnaire. Author MSAM entered the data and author SAB managed the analyses of the study. All authors trained the data collectors and supervised them during data collection. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMRR/2016/28539

Editor(s):

(1) Rui Yu, Environmental Sciences & Engineering, Gillings School of Global Public Health, The University of North Carolina at Chapel Hill, USA.

Reviewers:

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(3) Sharaye Kolade Oladele, ABU Teaching Hospital, Nigeria.

Complete Peer review History: <http://www.sciencedomain.org/review-history/16919>

Original Research Article

Received 24th July 2016
Accepted 6th November 2016
Published 14th November 2016

ABSTRACT

Background Information: Cardiovascular diseases (CVDs) are number one killer in the world among non-communicable diseases (NCDs). The principal underlying risk factor for CVDs is hypertension (HTN).

Objectives: To identify the prevalence of hypertension, the stages of HTN and the related risk factors such as age, sex, smoking and body mass index (BMI) among the population in Khartoum

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locality, Sudan, 2014

Methods: A community based cross-sectional study was carried out in Khartoum locality during March- April 2014. A total of 948 adult individual were interviewed using structured questionnaire that was filled by medical officers, house officers and semi-final medical students. Blood pressure (BP) was measured twice with 5-6 minutes in-between. Hypertension was considered as ≥ 140 mmHg and ≥ 90 mmHg for systole and diastole BP respectively. The international classification of BMI was used for underweight, normal, overweight and obesity.

Analysis: Prevalence of HTN and the stages was measured by descriptive statistics. Multiple logistic regressions was used to test relationships of age, sex, smoking and BMI with stages of hypertension, pre-HTN, stage one HTN, stage two HTN, isolated systolic hypertension (ISHTN) and isolated diastolic hypertension (IDHTN).

Results: More than half of the population (51.3%) was in the age group 18-36 years. Males and females account to 44.7% and 55.3% respectively. Overweight and obesity was detected in 59.1% of the study population. Most of the study populations were non-smokers (88.8%). Pre-HTN, HTN (stage one and two), ISHTN and IDHTN were 7.7%, 10.7%, 9.4% and 7.9 respectively.

Smoking contributed to occurrence of pre-HTN by 5.7%. It has no contribution to other stages of HTN. Male sex is the contributing factor for occurrence of pre-HTN, stage one HTN and stage two HTN, Odd Ratios: 4.555, 8.355 and 6.588 respectively. Overweight contributes to all stages of HTN by various degrees. Age is also a contributory factor for stage one HTN, stage two HTN and ISHTN.

Conclusion: Prevalence of different stages of HTN in Khartoum locality was high. Overweight contributes to all stages of HTN. Age and male sex were not contributing to pre-HTN and ISHTN respectively.

Keywords: Hypertension; stage one and two hypertension; isolated systolic hypertension; isolated diastolic hypertension; Khartoum locality; Sudan.

1. INTRODUCTION

1.1 Levels of High Blood Pressure

CVDs are the top killers in the world among NCDs. The main precipitated risk factor for CVDs HTN. It causes 50% of ischemic heart disease, and more than 60% of stroke worldwide [1]. About 30% of adults worldwide are hypertensive and up to 30% of mortality among adults is attributed to HTN, this is mainly related to the stage/level of BP, where the risk for CVDs is doubled with the increase of 10 mmHg in diastolic blood pressure(DBP) and/or 20 mmHg in systolic [2]. Prevalence of hypertension varies around the world, with the lowest prevalence in rural India (3.4% in men and 6.8% in women) and the highest prevalence in Poland (68.9% in men and 72.5% in women) [3]. The prevalence of HTN in Eastern Mediterranean region was 26% in the past century and it has a rising trend over recent years [4]. The country profiles regarding NCDs reflected a prevalence of HTN in Lebanon, Saudi Arabia and Kuwait as 39%, 33.1% and 29.1% respectively. In Africa; the prevalence of HTN in Libya, Morocco and Egypt was found to be 42.6%, 41.2% and 35% respectively [5]. There is different levels of high blood pressure determined the stages of HTN as follows: pre-

HTN, stage 1 HTN, stage 2 HTN, ISHTN and IDHTN [6]. Pre-HTN refers to individuals with high normal BP whose chance of developing HTN is higher than those with normal BP [6]. That is why the term elevated or high BP is used instead of HTN [6]. This classification of stages helps to assess the risk of high BP that could contribute to CVDs occurrence [6].

1.2 Risk Factors of High Blood Pressure

High BP has many risk factors including age that shows positive relationship throughout life [7]. Sex contributes to the level of BP as young and middle age females have lower levels of blood pressure than middle age males and this difference reduces later in life [8]. Smoking raises the blood pressure as the chemicals in tobacco can damage the lining of the artery walls causing narrowing leading to increase in BP [9]. BP increases progressively with the increase in body weight [10]. It was found that there is an increase of 4 mmHg in BP for each 4.5 kg increase in body weight [10]. Reduction and preservation of healthy body weight within normal range of 20 and 25 Body Mass Index (BMI) reduces the BP of normotensive as well as the hypertensive ones [10]. Most of risk factors of high BP are modifiable lifestyle factors including obesity, high

salt intake, stress, smoking, and sedentary life [11]. Lifestyle modifications are the powerful non-pharmacological measures that help in maintain normal BP and preventing its complication [12]. Non-pharmacological measures include exercise, stress management, smoking cessation, maintaining normal body weight, dietary modification, and lowering sodium chloride intake [12].

The incidence of HTN has increased rapidly in the Sudan in the last few years [13]. To the best of our knowledge, the high BP and its stages are not studied in the last few years in Khartoum locality with the emphasis on related risk factors. The aim of this study was to identify the prevalence of HTN, the stages of HTN and the related risk factors including age, sex, smoking and BMI among the population in Khartoum locality.

2. POPULATION AND METHODS

2.1 Study Design

This is a descriptive community-based cross-sectional study.

2.2 Study Area

The study was carried out in Khartoum locality which spread approximately across 176 square kilometres area and inhabited by 639,598 of the population. Khartoum locality is one of the seven localities in Khartoum State. It consists of six local administrative units and 157 blocks.

2.3 Study Population

The target population was the individual males and females aged 18 years and above. Households in Khartoum locality was the study unit. The eligible males and females who were included in this study have been Khartoum residents for the last two years at the time of the study.

2.4 Sample Size

Sample size was calculated according to the following equation:

$$n = \frac{z^2 pq * deff}{d^2}$$

Where;

n is the desired sample size
z is standard normal deviate=1.96

p is the prevalence of occurrence, 0.24% according to Sudan household survey in 2010 [14].

q is (1- p) = 0.76

d is the desired margin of error = 0.04

deff is the design effect for multistage cluster sample = 2

Therefore; the target sample size is $438 * 2 = 876$ individuals.

To avoid the replacement in case of missing data, the sample size was increased by 8 % to give a total of 948 participants. The average individuals in each household were four that covered 237 households.

2.5 Sampling Technique

The sample of individuals from each administrative unit in Khartoum locality was calculated proportional to population size. One block from each of the six administrative units was selected by simple random sampling. The first household within the block was randomly selected and thereafter every second house was visited. In cases of absence or refusal to participate, neighbouring house was chosen.

2.6 Data Collection and Analysis

Data collection tool was structured close ended questionnaire. The questionnaire is composed of two parts. The first part contains the variables of population characteristics, age, sex and smoking status. The second part is for recording the level of systolic and DBP, weight and height.

BP was measured by calibrated mercury sphygmomanometers before and after the interview. The first measurement was taken after 5 minutes rest while the participant is seated in a comfortable seat and the arm at the level of the heart. Systolic blood pressure (SBP) taken upon hearing the first sound, and DBP upon complete disappearance of Korotkoff sounds. The second BP measurement was taken after the interview. The minimum interview time was estimated at 5-6 minutes. The averages of the two measurements were used for further analysis.

A portable calibrated weighing scale was used to measure the body weight with the subjects wearing light clothes and bare foot. The height was measured using a traditional cloth tape measure. BMI is the common medical standard indicator used to measure over weight and obesity [15]. It is calculated by the following equation:

$$\text{BMI (Kg/Htm}^2) = \frac{\text{Weight}}{\text{Height}^2}$$

Classification of BMI was considered based on WHO reference criteria. BMI less than 18.5 was considered as underweight, 18.5-25 as normal, above 25 and < 30 kg/m² as overweight and 30 or more as obese [11].

Data collectors were medical officers, house officers and semi-final medical students from the Faculties of Medicine in University of Khartoum and International Africa University. They were trained on the data collection, calibration of sphygmomanometers and the skills of measuring BP. They were also trained for calibration of the portable weighing scales and how to measure weight and height perfectly. Data collection took about six weeks from 8th March to 22nd April 2014.

Authorization was obtained from the ethical committee of Sudan Society of Hypertension (SSH). Permission was taken from each administrative unit before the start of the study. An informed consent was signed by the selected individuals before filling in the questionnaire and all personal information and measurements were kept confidential.

Data was cleaned, entered and managed in SPSS version 20. Description statistics in terms of frequency counts and percentages were used for qualitative variables. The measures of hypertension were re-coded in SPSS program as follows:

- 1) Normal BP 120/80 mmHg
- 2) Pre-hypertension 120 to 139 mmHg over 80 to 89 mmHg
- 3) Stage one HTN 140-159 mmHg / 90-99 mmHg
- 4) Stage two HTN > 160 mmHg / >100 mmHg
- 5) ISHTN > 140 mmHg / < 90 mmHg [6].
- 6) IDHTN > 90 mmHg / < 140 mm Hg [16].

There after descriptive statistics presents the frequency of each stage. Multiple logistic regressions used to test relationship of age, sex, smoking and BMI to stages of hypertension: Pre-HTN, stage one HTN; stage two HTN; ISHTN; and IDHTN. Significance level was taken at 95 confidence interval level.

3. RESULTS

The sex distribution of the sample selected is 44.7% males and 55.3% females (Table 1).

Almost half of the sample (51.3%) is younger (age group 18-36) and around third of them (32.8%) in the middle age (>36-56 years) (Table 1). More than half of the study population are both overweight or obese, 29.2% and 29.9% respectively (Fig. 1). Regarding smoking status, 88.8% are not smokers (Table 1). Excluding pre-HTN which accounted to 7.7, the prevalence of other stages of hypertension is found to be 28% where HTN stage one and two, ISHTN and IDHTN account to 10.7%, 9.4% and 7.9% respectively (Table 1).

The overall elevated blood pressure, including all stages is found among 338 individuals (35.7%). Of them; 21.6% are having pre-HTN stage, 20.1% stage one HTN, 9.8% stage two HTN, 26.3% ISHTN and 22.2% IDHTN (Fig. 2).

Table 2 showed the factors related to different stages of high blood pressure. Male sex, overweight and smoking is the risk factors associated with pre-HTN, ORs are 4.555, 0.183 and 0.057 respectively. The model excluded smoking as a risk factor for stage one HTN and kept male sex, overweight, younger and middle age population, ORs are 8.355, 0.182, 0.036 and 0.214 respectively (Table 2). Male sex, overweight and middle age population are the risk factors associated with stage two HTN (Table 2). Overweight, younger and middle age population are the risk factors for ISHTN (Table 2).

Table 1. Characteristics of the study population (n=948)

Characteristics		N (%)
Sex	Male	424(44.7)
	Female	524(55.3)
Age	18-36 years	486(51.3)
	>36-56 years	311(32.8)
	More than 56	151(15.9)
Smoking status	Smoker	82(8.6)
	Non-Smoker	841(88.8)
	Ex-Smoker	25(2.6)
Blood pressure status	Normal	610(64.3)
	Pre-hypertension	73(7.7)
	High (stage 1&2)	101(10.7)
	ISHTN	89(9.4)
	IDHTN	75(7.9)

4. DISCUSSION

In this study obesity and overweight were more prevailing than under-weight. This finding is similar to the result of Khartoum Stepwise Survey (KSS) 2006 where the prevalence of overweight

and obesity was (31% and 22.9%) respectively [17]. Overweight had contribution to BP elevation in all high BP stages in this study. An increase of 4.5 kg of body weight results in 4 mmHg increase in BP [10]. Khartoum locality is inhabited by Sudanese population from different ethnic groups and from different states of Sudan. The diversity of population in Khartoum resulted in behavioural differences in over stretched urban poor population. The negative lifestyle including eating fast food rich of oil and sedentary life had resulted in an increase in overweight and obesity. Weight reduction and preservation of healthy body weight within normal range between 18.5 and 25 BMI reduces the BP of both normotensive and hypertensive people [10]. Male sex is a predictor to elevated BP in all stages of hypertension except ISHTN. A study done in Thailand showed that the

prevalence of HTN and pre-HTN was higher in men compared to women, and was more common in urban compared to rural men [18]. High BP among males may be due to stress besides changing life style where the country is economically deprived. Urbanization in low income countries is one of the causes of stress due to work demands and low salaries. Age is significantly associated with HTN stage one and two and ISHTN in Khartoum locality. Multivariate logistic regression model in Assam study showed that the independent determinants of HTN were age, gender and intake of extra salt [19]. Age has an effect of the severity of HTN, for both males and females HTN increase with age [19]. Smoking is not a predictor for HTN (stage1 and 2) and ISHTN, this is may be due to the fact that only 7.7% of the study population were smoker.

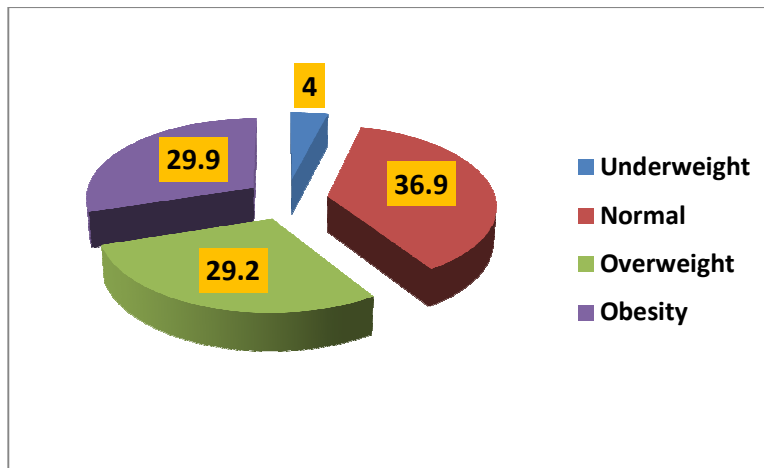


Fig. 1. Obesity and overweight among Khartoum locality population, Khartoum, Sudan, 2014. (n=948)

Table 2. Factors associated with types of hypertension among study population with high blood pressure in Khartoum Locality (n=338)

Type of hypertension*/mmHg	Factor	Odds ratio	95% confidence interval	P-value
Pre Hypertension (More than 120 - 139 / >80 - 89)	Male	4.555	1.948 , 10.650	0.001
	Over weight	0.183	0.073 , 0.457	0.001
	Smoker	0.057	0.004 , 0.848	0.038
Stage One Hypertension (140-159/ 90-99)	Male	8.355	3.348 , 20.847	0.001
	Over weight	0.182	0.072 , 0.457	0.001
	Age (18-36)Years	0.036	0.008 , 0.157	0.001
	Age (>36-56) Years	0.214	0.052 , 0.877	0.032
Stage Two Hypertension (More than 160 / >100)	Male	6.588	2.054 , 21.126	0.001
	Over weight	0.130	0.041 , 0.410	0.001
	Age (>36-56) Years	0.052	0.011 , 0.239	0.001
Isolated Systolic Hypertension (More than 140 / < 90)	Over weight	0.271	0.105 , 0.703	0.007
	Age (18-36)Years	0.006	0.001 , 0.028	0.001
	Age (>36-56) Years	0.070	0.018 , 0.268	0.001

*The model excluded isolated diastolic hypertension for redundancy

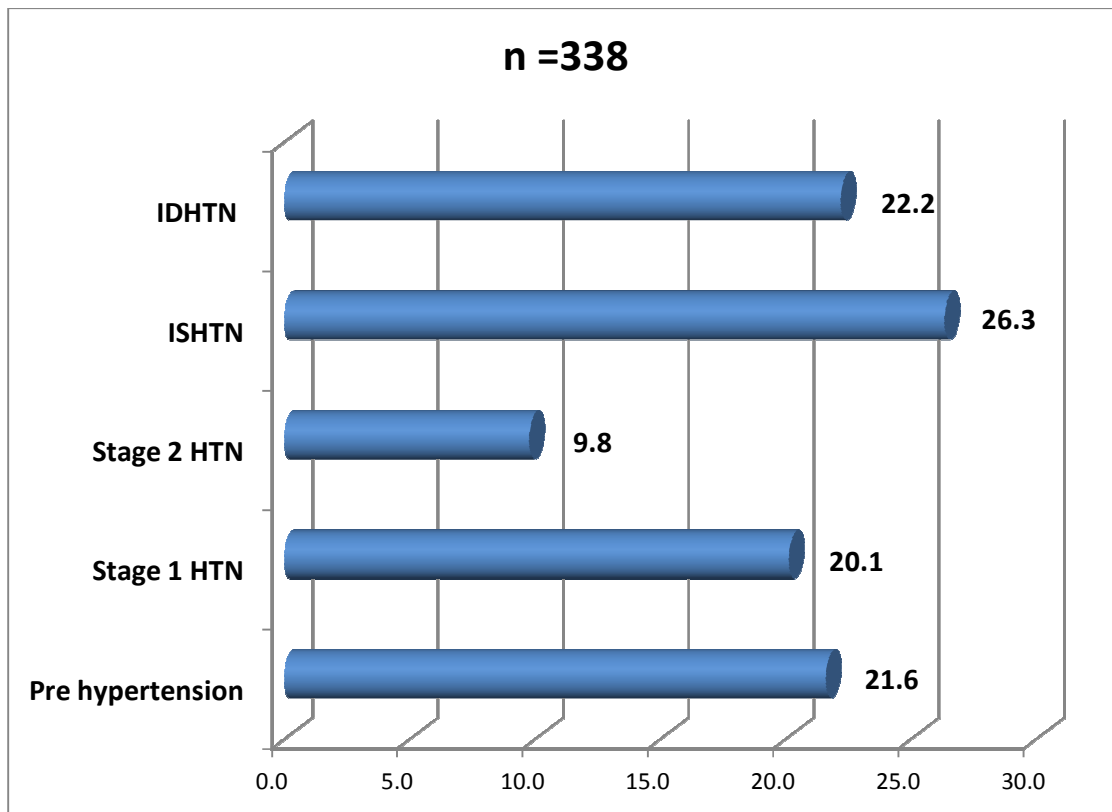


Fig. 2. Stages of high blood pressure among Khartoum locality population, Khartoum, Sudan, 2014 (n=338)

Prevalence of HTN in Khartoum is increasing over the past 10 years. Two surveys carried in 2006 and 2010 showed prevalence of 19.2% and 24.3% respectively [17,14]. In this study the prevalence of HTN was found to be 28%. The prevalence of HTN in this study is lower than that of Lebanon, Saudi Arabia and Kuwait [5].

It also low than the prevalence in Libya, Morocco and Egypt [5]. Sub-Saharan African (SSA) countries are currently experiencing one of the most rapid epidemiological transitions characterized by increasing urbanization and changing lifestyle factors [20]. The epidemic of HTN in SSA is driven by multiple factors working collectively [20]. Some lifestyle factors are considered gendered in that some are salient for women and others for men [20]. For instance, obesity is a predominant risk factor for women compared to men, but smoking still remains mostly a risk factor for men [20]. Additionally, structural and system level issues such as lack of infrastructure for healthcare, urbanization, poverty and lack of government programs also

drive this epidemic and hampers proper prevention [20].

In Khartoum locality, 28% of population with various stages of HTN had ISHTN and 22.2% had IDHTN. Stage one and two HTN in Saudi Arabia was 12.5% [21] compared to 10.7% in Khartoum locality. Although these two stages of HTN looks low but ISHTN prevalence in Khartoum locality is double the prevalence in Saudi Arabia [21]. IDHTN looks similar to the prevalence in Saudi Arabia [21]. Another study in Saudi Arabia reflected a high IDHTN prevalence than this study [22]. Historically, systolic hypertension was considered as an innocent change due to arterial stiffening. Recently; mild or moderate elevation of systolic blood pressure was associated with an increased risk of cardiovascular diseases in the presence of obesity and smoking [23]. The increase prevalence in IDHTN could be due to high salt intake in diet as far as Khartoum locality is located in Africa where most of the population increases their diet salt [23,24]. Reduction of salt predicts a fall in blood pressure in both

systolic/ diastolic hypertensive and also in normotensives [25]. According to European society of cardiology and European society of hypertension guidelines 2013, salt intake should be reduced to 5-6 g/day [26]. IDHTN has low risk for cardiovascular mortality and treatment of hypertensive population should be focused on systolic rather than on diastolic BP measurements [27].

The study recommended a strong consideration to deal with various stages of HTN at health facilities with emphasis on educational program fostering the healthy lifestyle in Khartoum locality.

5. CONCLUSION

Prevalence of hypertension in Khartoum locality, Khartoum State was high including different stages. Overweight is the associated risk factor for all stages. Male sex is not a predictor for ISHTN but predictor of other stages. Age is not associated with pre-HTN but it is a strong predictor for other stages of HTN. Life style and consideration of various stages of HTN are recommended.

ACKNOWLEDGEMENT

We would like to thank Prof. Haydar Ab Ahmed from the Community medicine Department, Faculty of Medicine, University of Khartoum, who reviewed the article.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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