

## Prevalence of Overweight/Obesity and Undiagnosed Hypertension among Military Personnel in Maiduguri, Nigeria

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### Abstract

**Background:** Hypertension and overweight/obesity are associated with high rates of morbidity and mortality, but prevalence data on these conditions are not readily available among occupational groups in Nigeria.

**Purpose:** To determine prevalence of overweight/obesity and undiagnosed hypertension and their association with Sociodemographic characteristics among military personnel in Maiduguri, Nigeria.

**Methods:** A cross-sectional survey was conducted among 385 military personnel. Blood pressure (BP), height and weight were assessed using standardized procedures. Hypertension was defined as BP  $\geq$  140/90 mmHg and BMI was classified according to WHO criteria.

**Result:** Prevalence of overweight/obesity and undiagnosed hypertension among military personnel in Maiduguri were 155 (40.3) and 32 (8.3%), Prevalence was significantly ( $p < 0.001$ ) higher among military personnel of 30-45 years old compared to their younger and much older counterparts and also among married military personnel compared to those not married ( $p < 0.001$ ). No difference was found for prevalence by gender, educational qualification and rank of military personnel ( $p > 0.05$ ). Being 30-45 years,  $\geq$  45 years or older and being married was positively associated with prevalence of undiagnosed hypertension and overweight/obesity. Whereas senior rank was negatively associated with overweight/obesity (OR=0.73, CI=0.28-1.90) and hypertension (OR=0.89, CI=0.17-4.69).

**Conclusion:** Comparable prevalence of obesity and undiagnosed hypertension were found among military personnel in Maiduguri. Findings shows higher prevalence of obesity among this cohort of military personnel suggests intervention measures for this group.

**Keywords:** Prevalence; Undiagnosed hypertension; Overweight/Obesity; Military personnel

### Introduction

The incidence of cardiovascular disease is rapidly increasing at an alarming rate world-wide and is currently considered as the leading cause of death in both developing and developed countries [1,2]. Report from population-based studies in developing countries, showed an increasing rate of all the cardiovascular risk factors including hypertension, diabetes, lipid profile abnormalities, and obesity [3-6]. Hypertension, a major public health problem worldwide, is associated with high rates of morbidity and mortality [7]. The majority of cases are asymptomatic and therefore, goes unrecognised and untreated, leading to a high risk of coronary artery disease, heart failure, renal failure, and cerebrovascular diseases [8-10]. According to the Seventh Report of Joins National Commission on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [11], hypertension may be define as a condition of chronically elevated blood pressure ( $>120/80$  mmHg) that is abnormal for an individual's age, sex, and race. Although hypertension is a common condition [12], little is known about its prevalence among military personnel in this part of the world.

Obesity has been shown to be associated with increased mortality [13-15], aggravate common medical conditions such as cardiovascular disease [16,17], and diabetes [18], and increase health costs [9,13,19]. It refers to a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems [19,20]. Since obesity has reached epidemic proportions globally, its presence among the military personnel may have adverse consequences on their overall health and efficiency. Also, the worsening prevalence of obesity in young civilian adults could hinder the recruitment and maintenance of military man power. Obesity is therefore a major health problem, with an increasing trend of overweight and obese individuals in developing countries. Being overweight or obese is known to contribute significantly to morbidity and mortality rates in various countries around the world [13-15,21].

Military service is inherently physically demanding therefore all military members must maintain prescribed levels of health and physical fitness. Weight in relation to height is a correlate of health and fitness hence; it is a criterion for recruitment to and continuation in military service in some countries [22]. A report in 2002, estimated that 13-18% of men and 17-43% of women between 17 and 20 years old in the United State exceeded military weight standards [22].

Furthermore, some studies reported a trend toward increasing cardiovascular risk factors among military personnel [23-25]. However, few studies in general have quantified the prevalence of undiagnosed hypertension and overweight/obesity among military personnel. Al-Asmary et al., [26] during a community based screening among military active duty personnel in Saudi-Arabia, reported prevalence of undiagnosed hypertension 17.53% and a combined prevalence of overweight/obesity of 66.8 %. In Brazil, prevalence of overweight/obesity among young military personnel was estimated at 36% [27]. Another study in Sudan reported prevalence of undiagnosed hypertension and overweight/obesity as 69.9% and 49.2%, respectively among the police forces [28].

Prevalence of overweight/obesity and hypertension has reached epidemic proportions globally with data from the developing countries like Nigeria scarcely available. Presently, there are few or no empirical data on the prevalence of undiagnosed hypertension and overweight/obesity among military personnel in Nigeria. The aim of the present study was therefore to determine the prevalence of undiagnosed hypertension and overweight/obesity among military personnel in Maiduguri, and also to investigate their association with selected Sociodemographic characteristics.

## Method

### Participants

Three hundred and eighty five (385) apparently healthy male and female military personnel (18-68 years) from the three available military barracks (Giwa army barracks, Maimalari army barracks, and Ngomari Air force barracks) in Maiduguri participated in this study. All the participants had no previous history and diagnosis of hypertension. Data was collected between March to June, 2012.

### Sampling technique

Sample of convenience was used to recruit the 385 military personnel.

### Study design

The design is a cross-sectional survey.

### Procedure

Participants' blood pressure was measured using digital sphygmomanometer (UB-512 Model, Life Source) while sitting. The blood pressure was measured with the participants' elbow in extension with the cuff of the sphygmomanometer wrapped around the arm approximately 2.5-5 cm above the cubital fossa and the centre of the cuff aligned with the brachial artery. The sphygmomanometer was turned on to inflate automatically. The reading of the blood pressure appeared on the screen of the digital sphygmomanometer and the value was recorded as non-hypertensive if it is below  $120/80 \pm 10$  mmHg [29]. For the participants whose blood pressure was  $\geq 140/90$  mmHg on first measurement, the measurement was re-taken two other times one week apart [29] and they were classified as hypertensive when the same readings of  $\geq 140/90$  mmHg were obtained.

Weight was measured with the participants standing erect and foot slightly apart on the weighing scale (Harson's model) without shoes

and with minimal clothing as possible. Participants' heights were measured with a stadiometer, with the participants standing barefooted and the movable headboard of the stadiometer brought into position over the most superior portion of the head. Height was measured to the nearest 0.1 cm. Body mass index (BMI) was calculated by dividing the participants' weight in kilogram by the square of their height in meter ( $\text{kg}/\text{m}^2$ ). The BMI was classified based on World Health Organization criteria, [19] as underweight if  $<18 \text{ kg}/\text{m}^2$ , normal weight if  $18.5\text{-}24.9 \text{ kg}/\text{m}^2$ , overweight if  $25\text{-}29.9$  and obese if  $\geq 30 \text{ kg}/\text{m}^2$ .

Socio-demographic information on age, gender, marital status, educational qualification, rank was also obtained from the participants. All participants provided informed consent before being allowed to participate in the study, and the institutional review committee of University of Maiduguri Teaching Hospital (UMTH) gave approval for the commencement of the study.

### Statistical Analysis

Estimates of the prevalence of undiagnosed hypertension and overweight/obesity and other categorical variables were reported as proportions. Continuous variables such as age were reported as mean. Chi statistics was used to compare prevalence's of undiagnosed hypertension, overweight/obesity among participants by sociodemographic characteristics; significance level was defined as a p value less than 0.05. Binary logistic regression analysis with calculated adjusted odds ratios (ORs) and 95% CIs were used to assess the associations between prevalence of undiagnosed hypertension and overweight/obesity with sociodemographic variables. ORs and 95% CIs were calculated against the reference category of the participants aged 18-29 years, those who were single, those with less secondary school education and those of the junior rank.

### Results

The sample comprised of 358(93%) male and 27(7%) female military personnel with a mean age and body mass index of  $32.8 \pm 8.5$  years and  $24.7 \pm 3.6 \text{ kg}/\text{m}^2$  respectively. The mean systolic blood pressure was  $122.7 \pm 16.2$  mmHg while the diastolic blood pressure was  $76.9 \pm 12.2$  mmHg. Participants' marital status, educational qualification, and rank are summarized in Table 1.

Table 2 shows prevalence of overweight/obesity and undiagnosed hypertension among the military personnel. Prevalence of normal, overweight and obesity were found to be 230(59.7%), 125(32.5%), 30(7.8%) respectively among the participants. Out of the 385 participants 353 (91.7%) were not hypertensive and 32(8.3) were measured to be hypertensive.

Table 3 shows the prevalence of undiagnosed hypertension among military personnel with sociodemographic characteristics. Prevalence of undiagnosed hypertension was 8.3% with a significant majority of hypertensive participants from 30-45 years 20(5.2%). Prevalence of undiagnosed hypertension was also significantly higher among married participants ( $n=28$ , 7.3%) than singles ( $n= 4$ , 1%). Prevalence was found to be higher though not statistically significant among male participants 31(8.1%) compared to their female counter parts, and among the junior military personnel 30(7.8) compared to their senior officers.

Table 4 shows prevalence of overweight/obesity and sociodemographic characteristics. Prevalence of overweight or obesity among participants was found to be high 40.3%. Prevalence was found

to be high though not statistically significant among male participants 143(37.1%) than female participants. It was also significantly high among 30-45 years, and married participants. Prevalence was also high among those with secondary school education compared to those with less or more secondary school education.

Variable	Value
Age (years)	
Mean ± SD	32.8 ± 8.5
Range	18 - 68
Body Mass Index	
Mean ± SD	24.7 ± 3.6
Blood pressure	
Mean ± SD	
Systolic blood pressure	122.7 ± 16.2
Diastolic blood pressure	76.9 ± 12.2
Gender n (%)	
Male	358 (93%)
Female	27 (7%)
Age group	
18-29	157(40.8%)
30-45	203(52.7%)
≥45	25(6.5%)
Marital Status	
Single	
Married	152(39.5%)
	233(60.5%)
Educational Level	
<secondary	8(2.1%)
Secondary	249 (64.7%)
>secondary	128(33.2%)
Rank	
Junior Rank	362(94%)

Senior Rank	23(6%)
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**Table 1:** Socio-demographic Characteristics of the Participants

Description	N	%
Non Hypertensive	353	91.7
Hypertensive	32	8.3
Total	385	100
Normal	230	59.7
Overweight	125	32.5
Obese	30	7.8
Total	385	100

N= Number of participants

**Table 2:** Prevalence of Overweight/Obesity and Undiagnosed Hypertension among the Participants

Variables	n(%)	(% Non HPT (%HPT)		p-value
		n=353	n=32	
Prevalence	385(100%)	91.7	8.3	0.233
Gender				
Male		327(84.9)	31(8.1)	
Female		26(6.8)	1(0.3)	< 0.001*
Age group				
18-29		153(39.7)	4(1)	0.001*
30-45		183(47.5)	20(5.2)	
≥45		17(4.4)	8(2.1)	0.224
Marital Status				
Single		148(38.4)	4(1)	0.588
Married		205(53.2)	28(7.3)	
Educational Level				
<secondary		6(1.6)	2(0.5)	
Secondary		229(59.5)	20(5.2)	
>secondary		118(30.6)	20(2.6)	
Rank				
Junior		332(86.2)	30(7.8)	
Senior		21(5.5)	2(0.5)	

\*-Significant at 0.05  
Non HTN= Non Hypertensive

HTN= Hypertensive

**Table 3:** Prevalence of undiagnosed hypertension among Military Personnel with different Socio-demographic characteristics

Variables	n(%)	n=230 n=155		p-value
		(%) Normal	(%)overweight/obesity	
Prevalence	385(100)	59.7	40.3	
Gender				
Male		215(55.5)	143(37.1)	
Female		15(3.9)	12(3.1)	0.143
Age group				
18-29		117(30.4)	40(10.4)	<0.001*
30-45		105(27.5)	98(25.5)	
≥45		8(2.1)	17(4.4)	
Marital Status				
Single		110(28.6)	42(10.9)	<0.001*
Married		120(31.2)	113(29.4)	
Educational Level				
<secondary		-21.5	6(1.6)	
Secondary		156(40.5)	93(24.2)	0.063
>secondary		72(18.7)	56(14.5)	
Rank				
Junior		216(56.1)	146(37.9)	0.547
Senior		14(3.6)	9(2.3)	

\*-Significant at 0.05

**Table 4:** Prevalence of obesity/overweight among Military Personnel of different Socio-demographic characteristics

Table 5 shows ORs and CIs for the association between prevalence of undiagnosed hypertension and sociodemographic variables. The association shows that married participants were more than twice as likely to be hypertensive (OR=2.25, CI=0.64-7.97) than their single counterparts. Thirty to forty-five years olds were more than twice as likely to be hypertensive (OR=2.67, CI=0.76-9.47) than their much younger counterparts. The older age group (≥ 45 years) were significantly 10 times more likely to be hypertensive (OR=10.26, CI=2.15-48.92) than the much younger age groups. Those with more secondary school education were 2% less likely to be hypertensive than participants having less secondary and secondary school education (OR=0.98, CI=0.13-7.38). Senior ranking officers on the other hand were 11% less likely to be hypertensive.

Table 6 shows ORs and CIs for the association between prevalence of overweight/obesity and Sociodemographic characteristics. Female participants were more likely to be overweight/obese than the male in this study (OR=1.54, CI=0.66-3.56). Participants in the age group of

45 years or older were significantly four times more likely to be overweight/obese than their younger counterparts (OR=4.19, CI=1.47-11.97), with those in the age bracket of 30-45 years twice as likely to be overweight/obese than the younger age group (OR=2.21, CI=1.27-3.83). Senior ranking participants were 27% less likely to be overweight/obese than the junior ranking officers (OR=0.73, CI=0.28-1.90).

Variables	Undiagnosed OR	Hypertension 95 % CI
Gender		
Male	1	
Female	0.68	0.08-5.57
Age group		
18-29	1	
30-45	2.67	0.76-9.47
≥45	10.26	2.15-48.92*
Marital Status		
Single	1	
Married	2.25	0.64-7.97
Educational Level		
<secondary	1	
Secondary	1.01	0.42-2.43
>secondary	0.98	0.13-7.38
Rank		
Junior	1	
Senior	0.89	0.17-4.69

OR: odds ratios, \*significant odds ratios  
CI: confidence interval

**Table 5:** Associations between socio-demographic variables and undiagnosed hypertension (n=385)

## Discussion

The aim of this study is to determine the prevalence of overweight/obesity and undiagnosed hypertension and their association with selected sociodemographic variables of military personnel in Maiduguri, Nigeria. To our knowledge, this is the first study which combined prevalence of overweight/obesity and its association with selected sociodemographic variables among military personnel in Nigeria. The study showed a high combined prevalence of overweight/obesity (40.3%) among the military personnel in Maiduguri with 32.5% and 7.8% prevalence of overweight and obesity respectively. The prevalence in overweight/obesity observed in our study is comparable to a recent finding from the cardiovascular (heart) diseases polls conducted in May, 2014 in Nigeria [30] that revealed 48% of the studied population are either overweight or obese. It is moreover, comparable to a study on the prevalence of obesity in a Nigerian military population that reported 40.4% of Nigerian military personnel

to be either overweight or obese [31]. Prevalence of overweight/obesity was also consistent with those found among young military personnel in Brazil that reported 36% prevalence [27]. The estimated prevalence of overweight observed among military personnel in this study reported similar findings of 38% prevalence of overweight reported in a study by Al-Asmary et al in a community based screening among military active duty personnel in Saudi-Arabia, however their findings on the prevalence of obesity 28.8% was higher than the one reported in our study [26], but the combined overall prevalence of overweight/obesity 66.8% among their respondents was higher than the combined prevalence reported in our study. Similarly, a study at a USA Navy medical centre found a prevalence of overweight/obesity of 53% [32], which was higher than the figure in the present study.

Variables	Obesity/Overweight OR 95 % CI	
Gender		
Male	1	
Female	1.54	0.66-3.56
Age group		
18-29	1	
30-45	2.21	1.27-3.83*
≥45	4.19	1.47-11.97*
Marital Status		
Single	1	
Married	1.48	0.85-2.57
Educational Level		
<secondary	1	
Secondary	0.78	0.48-1.27
>secondary	2	0.33-12.4
Rank		
Junior	1	
Senior	0.73	0.28-1.90
OR: odds ratios, *significant odds ratios CI: confidence interval		

**Table 6:** Associations between socio-demographic variables and overweight/obesity (n=385)

Prevalence of overweight/obesity reported in this study are higher than the 2008 WHO report on Nigeria which gave 26.8% and 6.5% for overweight and obesity, respectively [33] and the 20% (overweight) and 5% (obesity) reported in two villages in South-Western Nigeria [34]. However, prevalence of overweight and obesity reported in the present study is lower than the one reported in a Northern city of Nigeria where overweight and obesity prevalence were as high as 53.3% and 21% respectively [35]. Specifically, in a systematic review, which included only four good-quality community wide studies in Nigeria, Chukwuonye et al., [21], found that the prevalence of overweight ranged from 20.3% to 35.1%, while the prevalence of

obesity ranged from 8.1% to 22.2% which agrees with the present study. The prevalence of obesity as reported by previous studies on other African countries is also higher than those reported in the present study. In the Republic of Benin, Ghana, Tanzania prevalence of obesity is as high as 18% and 13.6%,19.2% respectively [36-38]. Similarly, systematic reviews of the literature on overweight and obesity carried out in other parts of the world have also showed a high prevalence of overweight/obesity [39-41] showing overweight/obesity as one of the leading global epidemic. In the US, the prevalence of obesity has risen from 22.9% in the late 1980s and early 1990s to 30.5% between 1999 and 2000 [42].

The prevalence of overweight/obesity observed among this cohort of Nigerian military personnel corroborates previous studies among the same occupational group [26, 27, 31, 32]. This prevalence observed is high and needs to be of concern in Nigeria, where medical services are not easily accessible for frequent checkups as in the already developed countries. Moreover, overweight and obesity are correlates of poor health and physical fitness. The function of the military personnel to defend and protect the citizenry and the nation at large especially in security challenged region as Maiduguri can never be over-emphasised. Higher prevalence of overweight/obesity among them bares the nation to the consequence of this increasing global epidemic, which can eventually affect the level to which they discharge their duties and performance. According to Athekame, [43] Functional efficiency required by military personnel to support and defend the constitution of Nigeria against all enemies, foreign and domestic; ensured by timely and effective military action, the security of the country, its territories, and areas vital to its interest; and uphold and advance the national policies and interests of the country depend on strength possessed, which depend upon the physical fitness, endurance and health condition of the individual unit or command in which it is composed [44].

Few data exist on the prevalence of undiagnosed hypertension and its association with sociodemographic variables among military personnel in Nigeria with no study among this occupational group in Maiduguri, Nigeria. The study showed a much lower prevalence of undiagnosed hypertension (8.3%) to already existing population based studies of undiagnosed hypertension in Nigeria of 30-40% [45-49]. In a similar fashion prevalence observed in the present study was lower than the prevalence of undiagnosed hypertension 17.53% reported in a community based screening for pre-hypertension among military active duty personnel in Saudi-Arabia [26], and 27% prevalence of hypertension in a study of police forces in Khartoum, Sudan out of which 69.6% were newly diagnosed as hypertensive [28]. Prevalence of undiagnosed hypertension was however higher than findings from a recent study that reported 4.1% prevalence [50]. Perhaps the observed variations in prevalence of hypertension can be associated to work environment especially work stress and pressure [51], lifestyle and dietary habits, which have been documented to increase the incidence of hypertension [52].

These prevalence rates of overweight/obesity and undiagnosed hypertension among gender appear to be inconsistent with the prevalence reported in the study by Abu-Aisha [28]. The gender prevalence of undiagnosed hypertension reported in the present study is also lower than that reported by Al-Nozha et al., [53] in Saudi Arabia that showed the prevalence of hypertension in males as 28.6% and 23.9% in females. The study by [27] unlike the present study did not stratify the prevalence of obesity and undiagnosed hypertension among military personnel by gender. Females in the present study

were less likely to be hypertensive and more likely to be overweight/obese, these disagree with findings by Smith et al., [54] that indicated women to be less likely than men to be overweight/obese in a 2000 and 2005 survey of health related behaviours among active duty personnel in the United States. However our study has reported a smaller size of the female population in our sample as compared to that of previous studies. However, proportion of female (1/27) and male (31/327) diagnosed with hypertension were comparably low despite the disproportional sample size differences between both genders. Therefore gender prevalence in this study should be interpreted with cautions.

In the present study, the prevalence of overweight/obesity and undiagnosed hypertension tends to be positively associated with age. With those 45 years or older 10 times more likely to be hypertensive and four times more likely to be overweight/obese compared to 30-45 years who were more than twice as likely to be hypertensive and overweight/obese. Affirming that overweight/obesity and undiagnosed hypertension increased with increasing age among the military personnel. This finding is not surprising because evidence indicates that increase in age is a predisposing factor to the development of hypertension and obesity [26,28,54-56].

Prevalence of overweight/obesity and undiagnosed hypertension were positively associated with married military personnel. A similar association of prevalence of overweight/obesity and being married was also reported by Smith et al., and Desalu et al., [54,57]. The higher prevalence and positive associations of overweight/obesity and undiagnosed hypertension among married military personnel in this study could be attributed to the fact that married personnel tend to be older and perhaps more exposed to a combination of family/home and work stress, are less physically active and may engage in unhealthy eating habits.

The prevalence of undiagnosed hypertension was negatively associated with more secondary school education and senior rank among military personnel in the present study this is inconsistent with the finding of Abu-Aisha [28], where hypertension was positively associated with more secondary school education. The study by Wenzel [27], also reported lower prevalence of hypertension among military personnel of higher education (19.9%) and senior rank (28.6%) compared to those with lower education and of junior rank. Perhaps, military personnel of senior rank in this study engages in more physical activity, and may have less stressful mental occupational demands than their junior counterparts of lower education and ranks. Overweight/obesity were positively associated with more secondary school education and negatively associated with senior rank. This cannot be explained by the possible confounding effect of the level of education, as this was an independent positive predictor of BMI. Also a higher military rank was a negative independent predictor of BMI [58]. People in the low socio-economic stratum have been thought to have a higher risk of overweight/obesity. Since a large segment of the military is made up of the junior ranks and their socio-economic status may be rated as low to middle income, this may explain the high rate of overweight/obesity in this group [59].

Military personnel from the various countries including Nigeria can be presumed to be exposed to varying levels of stress, pressures from work, family demands, life style and environmental differences which probably result in variations in the prevalence of overweight/obesity and undiagnosed hypertension reported across countries. Occupation-related stress has been considered to be a potentially important cardiovascular risk factor. Consequently, a bulk of investigations has

focused on the detection of cardiovascular risk factors and obesity in certain jobs [28,60-62]. However, military personnel are occupational group with special characteristics. Being away from their families for long periods, frequent movement away from their base for military manoeuvres, punctual attendance at their place of work, and work overload may contribute significantly to job strain, and consequently stress-related diseases [60,4,2] like obesity and hypertension.

This study has some limitations even though the cross-sectional study design provides reliable and valid information, longitudinal studies should be carried out in this area. The study was carried out among a small sample of Nigerian military personnel in Maiduguri; there is a need to target a larger sample of this occupational group in Nigeria. Findings from the present study may be difficult to generalize to the general population because the study participants were a unique group. Therefore results should be used with cautions on other sampled population. Despite the above limitations findings from this study has provided an insight into the prevalence of overweight/obesity and undiagnosed hypertension and its association with different Sociodemographic characteristics in a sampled military personnel in Nigeria. Findings from this study have implication for interventional measures among this occupational group in Nigeria.

## Conclusion

Higher prevalence of overweight/obesity compared to undiagnosed hypertension was found among military personnel in Maiduguri, Nigeria. Age, more secondary school education and being married were positively associated with overweight/obesity, while age and being married was positively associated with undiagnosed hypertension. More secondary school education and senior rank were negatively associated with undiagnosed hypertension among this occupational group. Life style modification and education on appropriate diet and physical exercise during formal and informal sessions may be warranted among this occupational group. Transformational Behavioural changes through military strategies should be addressed. Efforts to maintain healthy weight and achieve blood pressure control should be emphasized among military personnel as a practical and high yielding starting point to help keep the current hypertension and overweight epidemic under control.

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