

## GENDER CORRELATED INCIDENCE OF HYPERTENSION AND BODY MASS INDEX IN ASSORTED AGE GROUPS IN DAR ES SALAAM

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### ABSTRACT

**Objective:** Many developing countries are currently burdened by both under nutrition and rising rates of overweight and obesity. However, only a few reports are accessible from health workforce on recent trends and current epidemiology of obesity in Africa. Obesity has been renowned as a distinct best predictor of hypertension incidence, and is considered as a key cause of hypertension.

**Methods:** We conducted a cross-sectional survey of 833 persons in an age group of 15-65 years in Dar-es-Salaam, Tanzania. The height, weight, and blood pressure (BP) of volunteers were recorded and mean BMIs determined. The findings were grouped into underweight, normal, over weight and obese based on BMI values. Hypertension was determined from measurements of blood pressure. After pooling of data the results were grouped according to gender across the age group and these were correlated with their blood pressure and BMI values.

**Results:** When a Body Mass Index (BMI) comparison made between the genders females are exposed the uppermost, normal proportion of overweight/obese BMI (43.11%) than the male population (36.36%). Of the women, 15.59% and 29.05% of the men had hyper tension ( $\geq 140/90$  mmHg). We have distinguished a straight relation connecting hypertension and Overweight/ Obese BMI. A considerable association of hypertension and BMI to the genders was observed in the study.

**Conclusion:** Present study reflects that there is a relationship among gender, hypertension and BMI. Usually, an event of hypertension is originated as the obesity and age increases but the current study revealed that the BMI and age were the significant determinants of hypertension across the human health resources. Therefore the result recommends, about the worry for the prevention of obesity and hypertension as a public health problem.

**Keywords:** Hypertension, Gender, Obesity, BMI, Dar-Es-Salaam

### INTRODUCTION

There is a worldwide obesity epidemic with the prevalence of overweight and obesity exceeding 50% in almost all the regions of the world. Obesity is commonly defined as a body mass index (BMI) of 30 kg/m<sup>2</sup> or higher. It is characterised by excess accumulation of body fat in the body and is accompanied by minimal physical work or exercise, is a danger to the good health and well being of a person [1]. While under-nourishment is of concern to most people, over-nourishment is as well dangerous. Obesity can lead to development of several complications such as physical disabilities, metabolic disorders, cardiac failure, stroke, high blood pressure, respiratory problems, psychological effects, osteoarthritis of the weight-bearing joints, low life expectancy and vulnerability to accidents [2].

Many factors have been identified as the causative agents of obesity and they include hormones, high adipose cell count, heredity, defective metabolic mechanism, large fat cell, brown fat, lack of physical exercise and over-eating. The commonest cause is consumption of calories in excess of the normal body requirements [3]. Obesity is estimated to be a major cause of mortality and morbidity; it is estimated 2.6 million fatality worldwide and 2.3% of global burden of disease [4]. The extent of obesity or its absence is determined by using the BMI criteria proposed by Beaton et al [5]. Their study showed a consistently steeper slope of blood pressure with BMI for men and women. A BMI in an overweight or obese range can lead to hypertension which accounts for 6% of deaths worldwide.

Hypertension affects multiple organs and doubles the risk of cardiovascular diseases including coronary heart disease (CHD), congestive heart failure (CHF), ischemic and hemorrhagic stroke, renal failure and peripheral arterial disease [6, 7]. Since hypertension has proven to be a silent killer contributing to many deaths and considerably increasing morbidity worldwide, it is crucial to recognize the high risk individuals at a younger age since target organ damage is correlated with the duration of disease.

Average blood pressure reductions of 6.3/3.1 mm Hg include experimental through decrease in mean body weight of 9.2 kg [8].

Interpreting the relationship between blood pressure and BMI is further complicated by suggestions from some studies of a threshold effect, under which there come into view to be no connection between the variables [9]. Some of these studies are based on relatively small sample, and so have limited scope to detect true relationship [10]. A lower threshold effect has been suggested for women, who tend to exhibit weaker correlations between BMI and BP in all studies. The relationship between BMI and BP has long been the subject of research. Yet, only a few studies have been conducted on the trend of obesity in Africa [6, 11]. The Tanzania demographic and health surveys conducted in 1991-1992 and 1996 reported prevalence rates of 4.1% and 6.0%, respectively, for women aged 15- 49 yrs who lived in urban areas [12]; by 1999, a survey of 5654 women aged 25- 64 yrs from the city of Dar es Salaam showed a prevalence of 10.0% [13].

Despite a growing burden of obesity and hypertension in developing countries, there is limited information on the correlation of body mass index (BMI) to blood pressure (BP) in African populations. The association between increasing body mass index (BMI) and greater weight gain and risk of diabetes is most pronounced among Asians [14]. Among the very few studies available from the African continent on the relationship between blood pressure and BMI, one study has reported that BMI was positively associated with BP in the urban population of Dar-es-Salaam, Tanzania [13]. Documenting recent changes in the prevalence of obesity and underweight in this country undergoing the nutrition transition is of vital importance for planning public health nutrition policy. This study intends to generate relevant information that helps to understand the patterns of high BP in lean populations as well as in populations where the prevalence of obesity is growing rapidly. Such information would thus be relevant to the prevention and control of hypertension in developing countries.

**SUBJECTS AND METHODS**

A cross-sectional study was conducted. Total of 833 volunteers (506 Males, 327 Females) aged between 15-65 years were randomly selected in Dar es Salaam, Tanzania. The study was conducted during the Health check up camp conducted by IMTU Hospital in selected areas of Dares salaam. Volunteers were interviewed for their family history of blood pressure, intake of medications for the treatment of hypertension, habit of alcohol consumption, and tobacco smoking etc. using pro forma, their physical examinations and blood pressure were measured. Ethical clearance was completed from IMTU ethical committee.

The subjects (volunteers) were categorised into five age groups: 15 to 25 years Group I, 26 to 35 yrs Group II; 36 to 45yrs Group III; 46 to 55 yrs Group IV, and 56 to 65 yrs Group V. Physical measurements of weight, height, BMI and systolic and diastolic blood pressures were determined. Weight and height were measured with participants standing without shoes and wearing light clothing. For height measurements a wooden stadiometer was used and participants stood upright with the head under Frankfort plane and heights were recorded to nearby 0.5 cm; and weight was calculated in kilograms to the nearest 100 g.

BMI was calculated as weight divided by height squared (kg/m<sup>2</sup>). On the basis of BMI, all subjects were subsequently divided into four groups using the sex and age-specific BMI criteria of the International Obesity Task Force. According to the international guidelines BMI among 18.5~24.9 is normal 25~29.9 is overweight and >30 is considered to be obese.

Blood pressure was measured by using standard mercury sphygmomanometer, in a sitting position after the participant rested for at least 5 minutes on a chair with their backs supported and their arms bared and supported at heart level [15]. The correlation of

blood pressure with BMI was evaluated within each group by age and gender according to WHO classification [16].

**RESULTS**

A total of 833 individuals in the age group 15–65 years, participated in the study. Overall, 60% of the study participants were males and 40% were females. The data collected from each individual male and female with respect to their age, height, weight, body mass index and blood pressure are accessible in Table 1, 2 and 3.

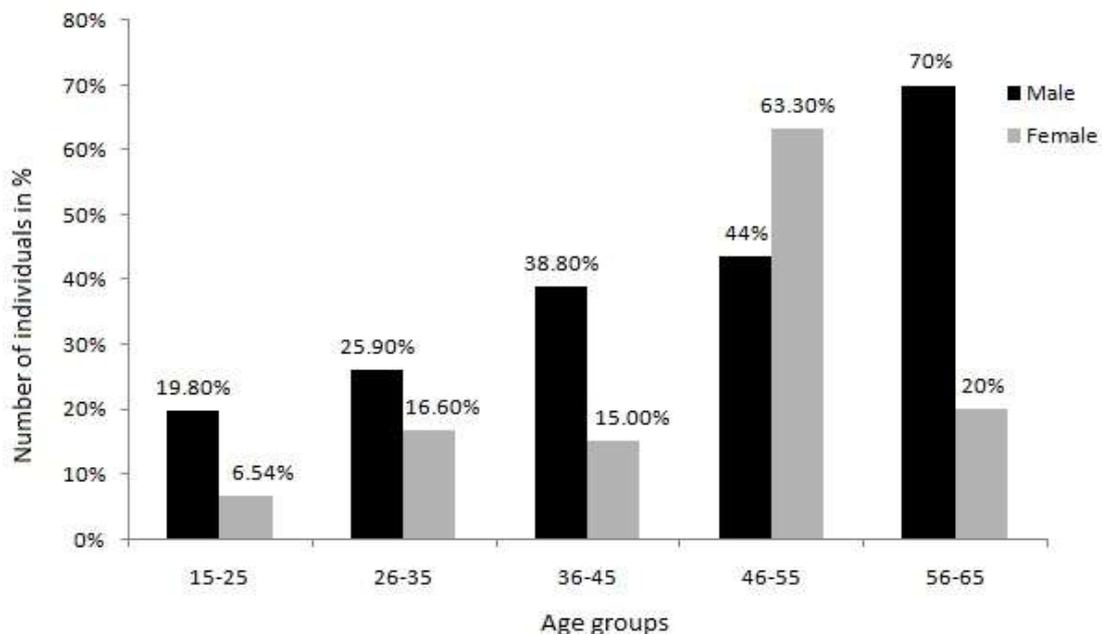
From the Table 1 and Fig. 1, it is evident that out of 506 male individuals, 147 (29%) were hypertensive. The number of male subjects with hypertension from the age group I up to V (15 to 65 years) is 43 out of 217, 35 out of 135, 28 out of 72, 27 out of 62, and 14 out of 20 respectively. Similarly, out of 327 female individuals only 51 (16%) were hypertensive. Number of females with hypertension from the age group I to V was 11 out of 168, 14 out of 84, 06 out of 40, 19 out of 30, and 01 out of 05 respectively.

The study reveals that average hypertension was high in male population (29.05%) as compared to that of female population (15.59%). High prevalence of hypertension was observed in males as compared to females of all age groups (Fig. 1), except group IV, (46-55 yrs). Data shown in Figure 2 revealed that the overweight/obese BMI condition was more prevalent in females as compared to males, in most of the age groups, except group III (36-45 yrs) and group V (56-65yrs).

Numbers of males having overweight and obese BMI were 27, 57, 48, 40 and 12 whereas females having overweight and obese BMI were 43, 46, 25, 25 and 02 in the age group I to V respectively (Table 2). Female population was showing the highest percentage of overweight with obese BMI (43.11%) than the male population (36.36%).

**Table 1: Distribution of hypertension across age groups in the male and female population**

BMI Status	Age Groups									
	15-25 (Group I)		26-35 (Group II)		36-45 (Group III)		46-55 (Group IV)		56-65 (Group V)	
	M	F	M	F	M	F	M	F	M	F
NORMAL	174	157	100	70	44	34	35	11	06	04
HYPERTENSION	43	11	35	14	28	06	27	19	14	01



**Fig. 1: Distribution of Hypertension among the different age group in both genders**

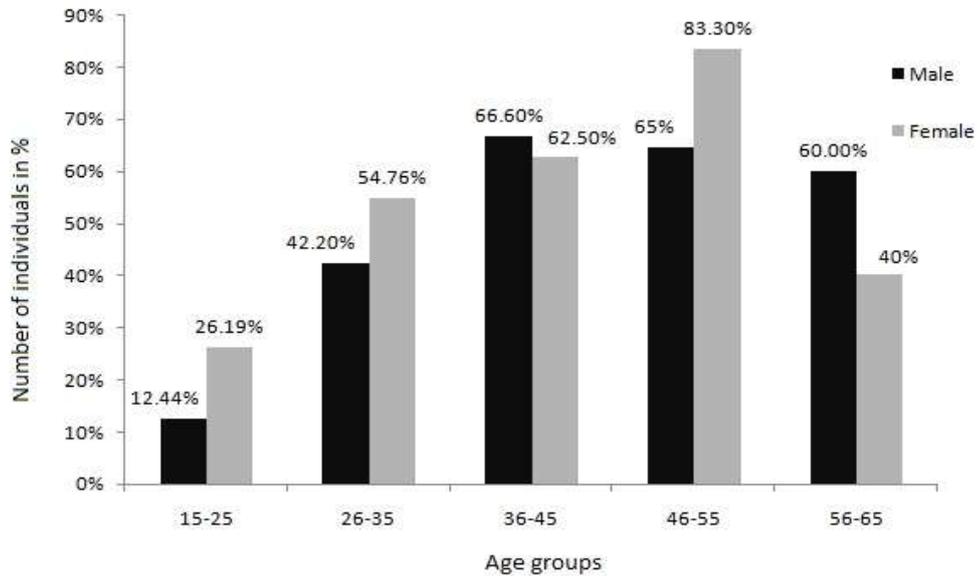


Fig. 2: Distribution of high BMI among the different age group in both genders

Table 2: Distribution of BMI across age groups in the male and female population

BMI STATUS	AGE GROUPS									
	15-25 (Group I)		26-35 (Group II)		36-45 (Group III)		46-55 (Group IV)		56-65 (Group V)	
	M	F	M	F	M	F	M	F	M	F
NORMAL	154	105	74	36	23	15	22	05	08	03
UNDERWEIGHT	36	20	04	02	01	-	-	-	-	-
OVERWEIGHT/OBESE	27	43	57	46	48	25	40	25	12	02

Table 3: Comparison of BMI groups with hypertension (WH) and without hypertension (WOH) among different age groups from the total study population

BMI STATUS	AGE GROUPS									
	15-25 (Group I)		26-35 (Group II)		36-45 (Group III)		46-55 (Group IV)		56-65 (Group V)	
	WH	WOH	WH	WOH	WH	WOH	WH	WOH	WH	WOH
NORMAL	34	225	16	94	5	33	8	19	5	6
UNDERWEIGHT	10	46	01	05	0	01	0	0	0	0
OVERWEIGHT/OBESE	09	61	40	63	27	46	30	35	06	08

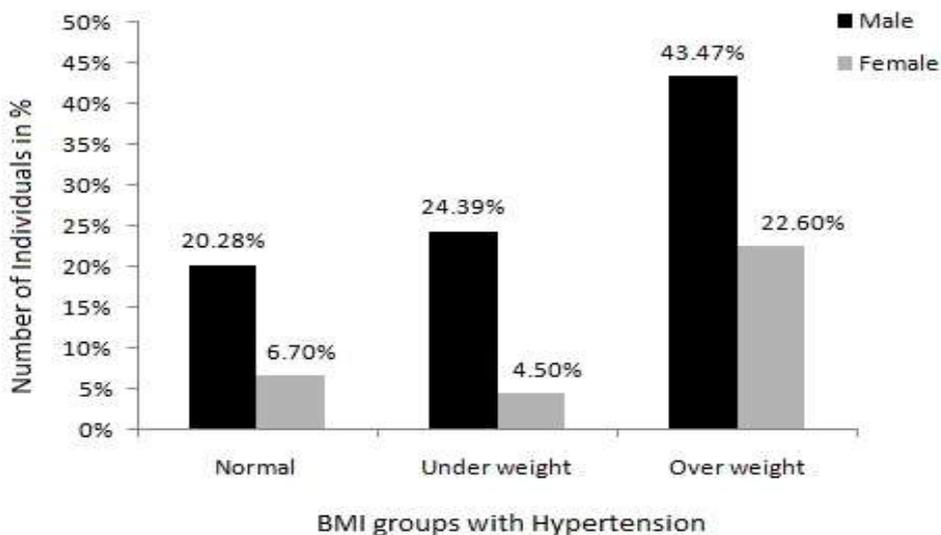


Fig. 3: Comparison of BMI groups with Hypertension among the total population

Considerable percentage of underweight individuals in both the genders were also observed but only in group I (15-25year) whereas in other age groups(II to V) almost negligible to zero percentage of underweight individuals was reported. Considering the total population, hypertension was found to be an important associated factor, because it is originate in the normal (15.28%), underweight (17.46%) and the overweight/obese (34.46%) categories (Table 3).

Fig. 3 shows the correlation between hypertension, gender and BMI, it is evident that in normal, underweight and overweight BMI groups males are having high percentage of hypertension. When the hypertension was compared among genders in all the BMI groups i.e, normal (20.28% males, 6.70% females), underweight (24.39% males, 4.50% females) and overweight/obese (43.47% males, 22.60% females), males were found to be more affected with hypertension.

## DISCUSSION

The relationship between BMI and blood pressure is playing a vital role to evaluate public health and the clinical impact. In males the prevalence of hypertension was gradually increased with the increasing age groups (from 15 to 65 yrs). Almost similar findings were reported in another study from Tanzania [13, 17].

Although there is a minor increase in number, in hypertensive females from 25-45 and 56-65 age groups, but significant rise in the number of hypertensive females were noticed only in a particular age group that is 46-55 years (63.3%), which belongs to the overweight category.

Hypertension was found in all age groups but mostly in the men (Fig. 1, with the exception of Group IV), these results are consistent with the finding of Anjum Humayun et al [18].

The explanations for the different patterns of BP in adolescents and adulthood among African descent populations are unclear and require a cohort study to find the possible mechanisms underlying these differences. One possible explanation may relate to generational differences or changes in lifestyles. Suitable dietary modifications that effectively lower BP such as weight loss decreased intake of NaCl, improved potassium intake, self-control of alcohol consumption. BP reductions in adolescents can be achieved by a combination of exercise and diet is more effective than either method alone in promoting fat loss [19]. These cost effective measures may lead to an important reduction in BP in adolescents thereby sparing the next generation from hypertension related complications.

The prevalence of obesity among Tanzanian men and women (35-64 years) in 1987-89 periods was 0.6% and 3.6% respectively [13]. In women attending ante-natal health centres in Tanzania, the occurrence of obesity greater than before from 3.6 to 9.1% from 1993 to 2004. In the present study, overall prevalence of obesity (36.36 M, 43.12% F) is drastically higher than reported. The highest rates of obesity were recorded in the age group of 46-55 years (65% in male, 83.3% in female). This shows that obesity is increasingly becoming a public health problem, something that should no longer be ignored in Tanzania.

From Fig. 2, it is obvious that BMI was found to increase with the age of the subjects in both the genders. About 26% to 83.3% (15 to 55 yrs) are having high BMI in the female population whereas 12% to 66.6% (15 to 45 years) among the males. Thus BMI is strongly related with age and gender. This is in agreement with the findings by Antia[2] who found that obesity tended to increase with age and was most likely to occur after the age of 35 years. Reduced physical activity may explain this observation. Brown and Konner[20] observed that most traditional cultures in developing countries tend to view "plumpness", especially among married ladies as an ideal condition of feminine beauty. Hence higher prevalence of obesity among female subjects in this study is not surprising.

It is evident that females are suffering more with overweight or obesity (43.11%) as compared to males (36.36%) from the total study population (Table 2). Physical inactivity could be the strong risk factor for obesity. Rapid urbanization in Tanzania, from 21.7%

in 1990 to 35.4% in 2003, may also be a contributing factor to the increase in the prevalence of obesity. Since the mid-1990s, free market policies have favored the eruption of transnational fast-food chains and supermarkets that distribute and commercialize non-traditional foodstuffs [21].

Obesity is consistent with increases in the prevalence of other associated chronic situation, predominantly hypertension, diabetes and coronary heart disease. Comparatively, despite the overall increase in the rates of obesity prevalence is in women, only modest changes occurred in the prevalence of hypertension. According to Fig. 3, in both genders (43.47% in males and 22.6% in females); the overweight/ obese category shows the highest percentage of hypertension indicating a relationship between hypertension and high BMI (overweight/obese). While comparing the overweight/obese category in Table 2, it was seen that 36.60% (184) of the total male population (506) are affected with overweight/obese BMI while it was 43.12% (141) of the total female population (327). But in the Fig. 3, it is evident that despite of the high overweight/obese BMI percentage in female, the hypertension is more prevalent in male. i.e, among the total male population in the overweight/ obese category (184), 43.47% (80) are affected with hypertension. On the other hand, among 141 overweight/obese female population, only 22.60% (32) are having hypertension. It proves that hypertension has strong relation with gender rather than BMI.

It was also noted that 24.39% of the underweight category in male populations were having hypertension which is more than that of the percentage of female hypertensive in the overweight/obese category (Fig. 3). Most of the under weights are falling in the 15-25 yrs. Hypertension was more in this category may be due to stress from various sources like economic barriers, unemployment, studies, affairs or some family issues.

The incidence of hypertension in men was significantly high in obese BMI class in the age group of 40-59 years however; the results are consistent with Brown et al.[22]. These results may be closely related to diet and socioeconomic circumstances come across, particularly at this age group. The diet aspect was chiefly attributed to the taking part in social activities such as wedding parties, where the diet is mostly rich in calories and high in fat. Other factors include less work, lack of physical activities and low energy expenditure were noted which contribute to their rapid increase in BMI and subsequently higher BP.

Present study revealed the relationship between BMI and hypertension among the individuals of different age groups in Dare es salaam region. The individuals belonging to Group III to V (age 36-65) show direct correlation between hypertension and BMI in both the genders. Similar studies were conducted by Sorof and Daniels[23] where the positive correlation of blood pressure and obesity was recorded and among all demographic and clinical factors analysed, BMI was highly associated with hypertension.

In controversy, the current study BMI was inversely related with hyper tension among the Group I and II (age 15-35) individuals. Almost similar results were obtained by Burke et al.[24] in a recent study; they described an independent association between high blood pressure, overweight and obesity, as defined by the International Obesity Task Force, in a prospective study carried out in an Australian cohort of children followed up from age 9 to 25 years. Genovesi et al.[25] also reported similar results in a cross-sectional study carried out in a sample of school children in northern Italy.

The results of the study also revealed that only about one half of the study population were aware of the harmful effects of obesity and hypertension, and among them, mainly these were old or aged individuals. Majority of the young individuals, were not aware about the adverse effects of Hypertension.

## CONCLUSION

This study shows that hypertension is directly related to BMI. With increase in the BMI the trend of hypertension rises in both females and males. Thus the prevalence of hypertension and obesity are

gender specific and increases with age. Hypertension is directly related with age according to this study. The risk of hypertension is higher among various groups having overweight and obesity.

The current study also indicates the increase in the prevalence of obesity in females in Tanzania. These findings emphasize the growing concern about obesity and hypertension as a public health problem and the importance of public health measures for primary prevention of these conditions from beginning to end in order, instruction and communication. It is possible of great importance if such interventions are initiated at near the beginning period of life, for example by addition in school programme. In future effect of diet, socio-economic and psychological status shall be study to locate the origin of age, gender, BMI and hypertension.

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