Original Research Article

Hypertension and its association with Body Fat Composition among Chinese Community in Melaka, Malaysia, Cross Sectional Study.

Abstract

Introduction: Excess body fat and high blood pressure (BP) are important risk factors for increased cardiovascular morbidity and mortality, and both may have their roots of occurrence in childhood and adolescence. The present study aimed at determining the association between body fat composition and BP level among the Chinese community in Melaka, Malaysia.

Methodology: This is a cross-section study with the secondary data analysis of the health records of the patients who had attended the medical camps conducted in Melaka, Malaysia. The body fat and visceral fat were measured by using (Handheld Body Fat Scale Analyzer). The blood pressure measurement was done according to the Clinical Practice Guidelines, Ministry of Health, Malaysia. The participants who had systolic blood pressure (SBP) of 140 mmHg and/ or diastolic blood pressure (DBP) of 90 mmHg were defined as hypertension.

Results: The prevalence of hypertension among male participants was 42.5%, meanwhile, among female was 23.6%. The prevalence of overweight and obesity was higher among males (37%) compared to females (20.8%). Gender, body fat (%) and was found to be associated with systolic blood pressure. Visceral fat (%) was the only associated factor of diastolic blood pressure.

Conclusion: This study found that body and visceral fat compositions are significantly correlated with systolic BP and visceral fat composition is significantly correlated with

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diastolic BP. High body and visceral fat composition should be used as a measure of increased risk for hypertension among old age peoples.

Keywords: hypertension, body fat percentage, visceral fat percentage, body mass index

Introduction

Excess body fat and high blood pressure (BP) are important risk factors for increased cardiovascular morbidity and mortality, and both may have their roots of occurrence in childhood and adolescence.

Obesity is becoming more prevalent worldwide. It is defined as abnormal or excessive fat accumulation that may impair health. Due to its simplicity and association with diseases, Body Mass Index (BMI) is the most commonly used method to diagnose obesity at the population level [1]. However, the recommended BMI cut-off values for overweight and obesity have been criticised due to their inconsistent relationship with body fat percentage (BF%) [2-4].

Thus, BF% is regarded as one of the most important measurements for the diagnosis of obesity whereby excess BF% has been shown to be associated with metabolic dysregulation regardless of body weight [5]. Based on the recent National Health Morbidity Survey [6], by using the World Health Organization classification [7], the prevalence of overweight and obesity in Malaysia was 33.4% and 17.7% respectively.

World Health Organization (WHO) reported that one in six adults is obese and one in three has elevated blood pressure [8].

Having excess body fat and being overweight or obese negatively impacts health in many ways and can account for many diseases. Abdominal obesity may be harmful in women as waist circumference is an independent risk factor for developing coronary artery disease

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(CAD). Moreover, morbidly obese women had an odds ratio (OR) of 2.7 for CAD and 5.4 for hypertension which are higher than men [9].

Method

This is the secondary data analysis of the health records of the patients who had attended the medical camps conducted in Melaka, Malaysia. The demographic data such as gender, age, ethnicity was collected before the health screening. The anthropometric measurements were conducted, and the BMI of the participants was calculated as weigh divided by height squared (kg/m^2). The participants' BMI were categorized as Normal weight (18.5-24.9 kg/m^2) or overweight/ obese ($\geq$ 25 kg/m^2) by using the WHO recommended cut off value for BMI [1].

The body fat and visceral fat were measured by using (Handheld Body Fat Scale Analyzer). The body fat percentage (BF %) is classified according to Gallagher D, 2000 study, in which BF % of >23 among Asian males and BF % >35 among Asian females were considered as high adiposity [10].

The blood pressure measurement was done according to the Clinical Practice Guidelines; Management of Hypertension (MOH, 2018) [11]. The blood pressure was categorized with reference to the CPG as Normal (SBP <130 mmHg and DBP <85 mmHg), High Normal (SBP 130-139 mmHg and/ or 85-89 mmHg), and hypertension (SBP ≥140 mmHg and/ or DBP ≥90 mmHg) [11].

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The participants who had systolic blood pressure (SBP) of 140 mmHg and/ or diastolic blood pressure (DBP) of 90 mmHg or who were previously diagnosed hypertension were defined as hypertension [11].

The patients' data were recorded in Microsoft excel. Statistical analysis was carried out by using PASW Statistics for Windows, Version 18.0 (SPSS Inc., Chicago, USA). Descriptive analysis was conducted for the demographic variables and reported with the number (percentage) and mean (percentage). Continuous variables were tested for normality. The general linear model was used to test the association between blood pressure and other factors.

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Results

A total of 182 participants attended the health screening camp organized in the Chinese community. The health screening data of the participants age 18 years and above were included in the analysis, and therefore, a total of 179 patients' data was analyzed in the study. Among them, 73 (40.8%) were male and 106 (59.2%) were female. The mean age of participants was 46 (±17.14). The mean systolic and diastolic blood pressure, BMI and fat percentages were shown in Table 1.

Table 1. Sociodemographic characteristics and health profile among the study participants (n=179)

Variable	**Total (n=179)**	**Male (n=73)**	**Female (n=106)**
	Mean(±SD)	Mean(±SD)	Mean(±SD)
Age (years)	46.90 (±15.81)	45.64 (±16.80)	47.81 (±15.11)
Blood pressure			
Systolic blood pressure	128.50 (±21.21)	136.73 (±21.13)	123.02 (±19.50)
Diastolic blood pressure	80.75 (±11.80)	84.77 (±11.30)	78.08 (±11.41)
Body Mass Indexed			
BMI	23.13 (±3.79)	23.97 (±4.19)	22.56 (±3.39)
Fat percentage			

Body fat percentage	27.66 (±7.41)	22.59 (±7.14)	31.18 (±5.26)
Visceral fat percentage	7.26 (±4.74)	9.81 (±5.30)	5.50 (±3.34)

The prevalence of hypertension among male participants was 42.5%, meanwhile, among female were 23.6%. (Figure 1). The prevalence of overweight and obesity and body fat percentages were shown in Figures 2 and 3.

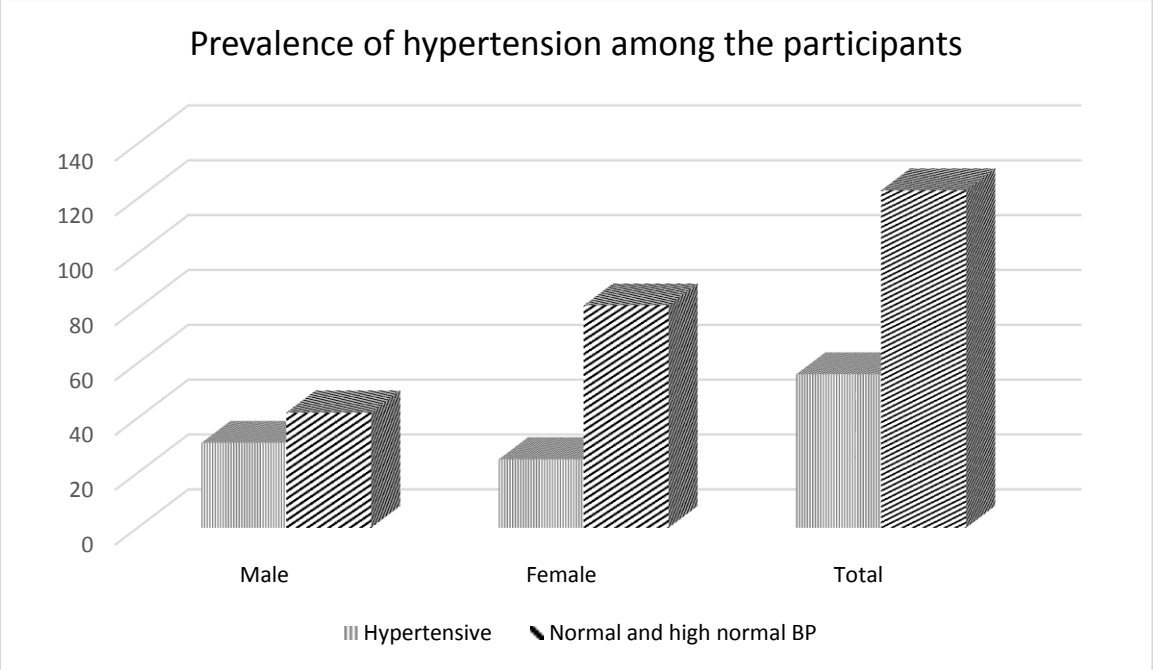

Figure 1. Prevalence of hypertension among the participants (n=179)

Normal and High Normal BP (SBP ≤139 mmHg and/ or ≤89 mmHg), hypertension (SBP ≥140 mmHg and/ or DBP ≥90 mmHg) or patients with previously diagnosed hypertension.

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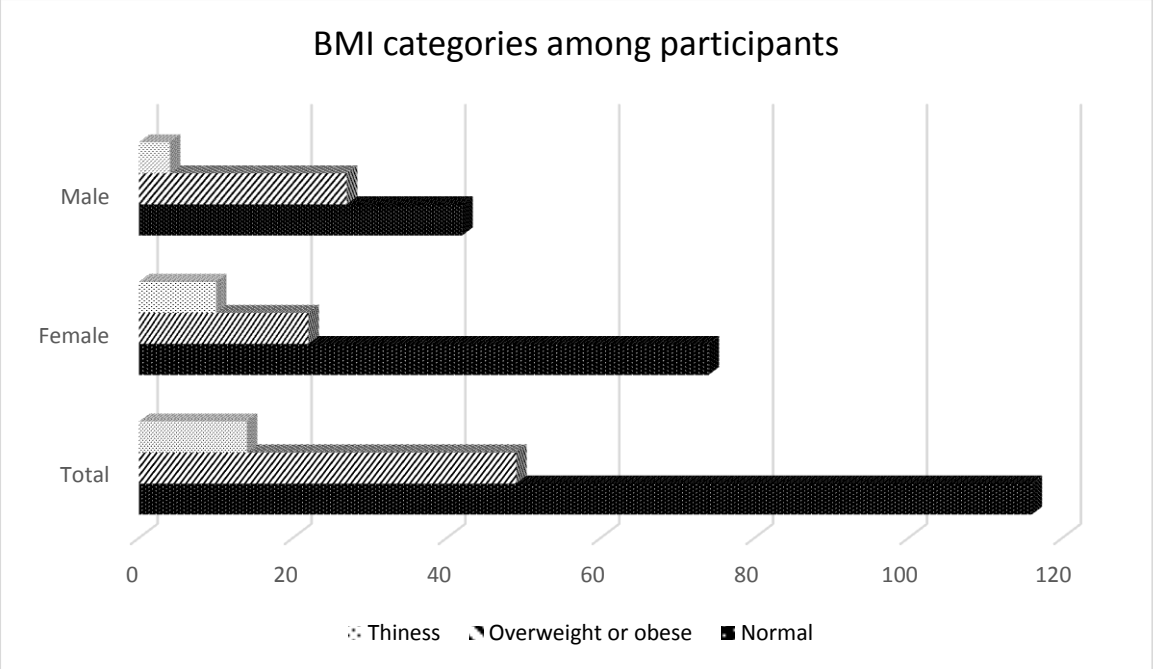

Figure 2. BMI categories among the participants (n=179)

Thinness (underweight) (<18.5 kg/ m^2), Normal weight (18.5-24.9 kg/ m^2), Overweight/ Obese (≥ 25 kg/m^2)

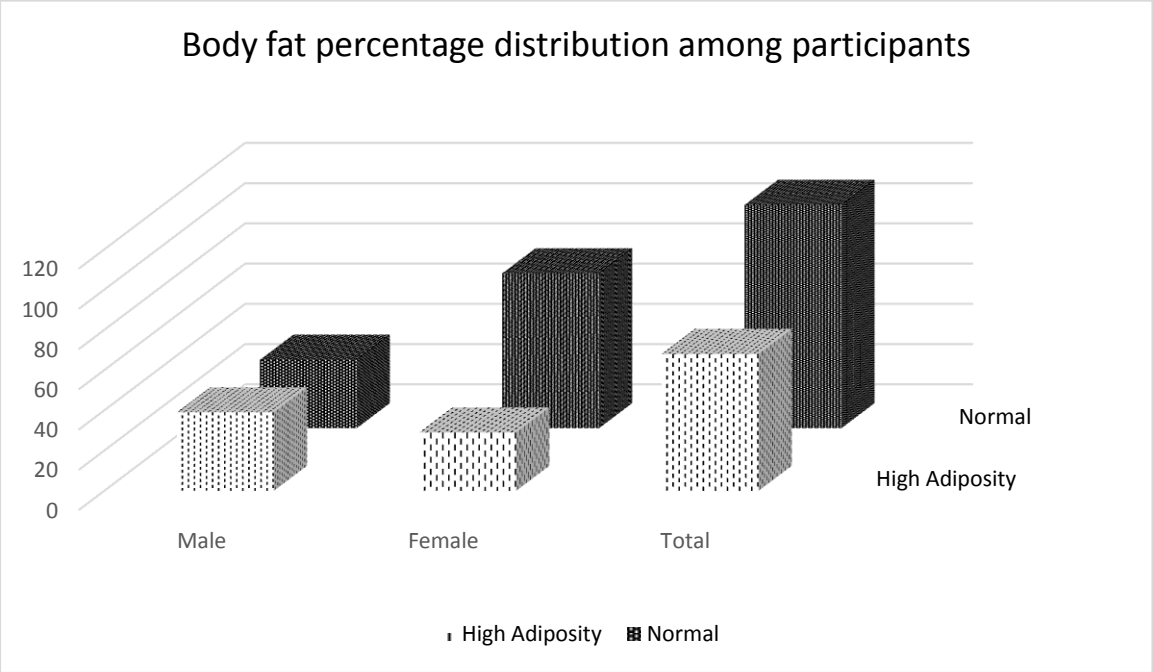

Figure 3. Body fat percentage distribution among participants (n=179)

High adiposity in Asian male: BF % of >23, High adiposity in Asian female: BF % >35

Table 2. Prevalence of overweight/obesity and high adiposity among the participants (n=179)

Variable	Total (n=179)	Male (n=73)	Female (n=106)
Blood pressure			
Normotensive	123(68.7)	42 (57.5)	81 (76.4)
Hypertensive	56 (31.3)	31 (42.5)	25 (23.6)
BMI	n(%)	n(%)	n(%)
Thinness	14 (7.8)	4 (5.5)	10 (9.4)
Normal	116 (64.8)	42 (57.5)	74 (69.8)
Overweight/ Obese	49 (27.4)	27 (37.0)	22 (20.8)
Body fat percentage			
Normal	111 (62)	34 (46.6)	77 (72.6)
High adiposity	68 (38)	39 (53.4)	29 (27.4)

The general linear model (GLM) was used to assess the association between blood pressure, gender, age, BMI, body fat (%) and visceral fat (%). Multicollinearity was checked for the continuous variables and variance inflation factor (VIF) >5 were considered as highly correlated factors.

Univariate analysis was conducted for each of the variables in association with the systolic and diastolic blood pressure. The variables with a significant level of >0.25 were included in the multivariate analysis. In the final model, gender, body fat (%) and visceral fat (%) were found to be associated with systolic blood pressure. Visceral fat (%) was the only associated factor of diastolic blood pressure (Table 3).

The mean blood pressure among females is 14.03 units less compared to males. Every unit increased in body fat (%), SBP is expected to increase by 0.70 unit and every unit increase in visceral fat (%), SBP is expected to increase by 1.27 unit provided that other variables remain unchanged. Meanwhile, every unit increased in visceral fat (%), DBP is expected to increase by 1.02 unit if other variables remain unchanged.

Table 3. Blood pressure and associated predictors in general linear model

Variable	Systolic Blood Pressure		
	Coefficient (B)	p-value	95% CI

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Gender (Female)	-14.03	0.01	-24.40_ -3.66
Gender (Male)	reference		
Body fat (%)	0.70	0.03	0.05-1.34
Visceral fat (%)	1.27	0.01	0.35-2.18
	Diastolic Blood Pressure		
Visceral fat (%)	1.02	<0.001	0.68-1.36

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Discussion

In this study, men have high BMI and women have low BMI. The prevalence of high adiposity is doubled among males compared to the female participants (53.4% vs 27.4%). The prevalence of high adiposity among females is lower compared to a study conducted in Malaysia, in which the prevalence of high BF% was 72.8% among women [12]. However, in that study, the majority of the participants were Malay and only 17.4% were Chinese women [12]. According to the previous studies, the prevalence of obesity is lower among Chinese women compared to the Malay and Indian ethnic groups [13]. The difference in the dietary pattern and calorie amount might contribute to the occurrence of lower obesity and lower BF % among Chinese women [13].

The finding in Pilly Chillo et al. [14] study could be explained by the observation that girls had higher BMI as well as higher body fat percentage and were more likely to be overweight and obese when compared to boys. As shown in the findings, systolic blood pressure was

much more associated with body fat percentage than diastolic blood pressure and hence the difference between men and women. Women were also more likely to report a family history of hypertension and generally, women were mostly sedentary. Both family history of hypertension and sedentary lifestyle are known risk factors for hypertension. However, in this study, men have high BP and high adiposity compared to women. This finding is contrary to the national health morbidity survey, in which there was no significant difference in the prevalence of hypertension by gender in Malaysia [15]. Meanwhile, the national survey in China reported that the prevalence of hypertension is higher among Chinese males [16].

The relationship between body composition and BP levels has well been established in epidemiological studies, and in adolescents and childhood, BP is positively correlated with age, weight, height as well as height/weight measurements [17,18].

The study conducted by Ghee LK, 2016 [13] found height, weight, BMI and waist circumference to positively and significantly correlated with both systolic and diastolic BP. In that study, the percentage of body fat was found to be correlated with systolic but not diastolic BP in the study participants.

Traditionally, body composition has been estimated by BMI as well as waist circumference and these have been shown to positively correlate with levels of BP.

Use of (Handheld Body Fat Scale Analyzer) on estimating body fat percentage, instead of more accurate methods like dual-energy x-ray absorptiometry or bioelectric impedance analysis may have contributed to differences in association between body fat percentage and BP. However (Handheld Body Fat Scale Analyzer) being one of the validated methods of measuring body fat composition is comparatively cheaper and can easily be applied in clinical settings.

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There are some limitations to the present study. First, this study attempted to assess the relationship between indices of body adiposity and hypertension. As these indices may have limitations as measures of body adiposity, their associations with hypertension could be under or over-estimated. Second, the "predictive ability" in this study refers to the ability to detect the presence of hypertension but not the ability to predict the future development of hypertension. Third, a BMI cut-off point of 30 kg/m^2 defines obesity. In the Asian population, a lower BMI cut-off might be more appropriate to assess the association between obesity and cardiometabolic risk factors, such as hypertension. For instance, Asians might have a high risk of developing cardiovascular diseases at a BMI of 27.5 kg/m^2 [19].

Understanding the roots of hypertension is therefore of major public health importance as a step towards primary intervention.

Conclusion

Hypertension is a growing but often hidden health problem of the Malaysian population, especially in the district and rural areas. Most hypertensive adults are less likely to be diagnosed, mainly due to the lack of regular access to primary health care. As body fat percentage can be measured and determined, it can be used as a screening tool by health professionals to identify in the community area at risk of hypertension and refer them for further diagnostic evaluation and subsequent medical treatment.

This study found that high body fat composition is significantly correlated with systolic BP. High body fat composition should be used as a measure of increased risk for hypertension among old age peoples.

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Body fat percentage measured by using (Handheld Body Fat Scale Analyzer), did not predict blood pressure level better than BMI in this population. High BMI also should be used as a measure of increased risk for hypertension among adolescents.

This is a small study and not generalizable and further larger studies are necessary to support this finding.

Consent for publication

Not applicable (Personal information was assessed. No identifying information.)

Ethics approval and consent to participate

The study protocol was approved by the Medical Research Ethics Committee of Faculty of Medicine, Melaka Manipal Medical College. Eligible respondents who agreed to participate in the study were required to initialize the informed consent form.

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