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Relation of Obesity and Hypertension among Chinese Community in Melaka, Malaysia–A Cross-sectional Study

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Authors' contributions

This work was carried out in collaboration among all authors. Author HL did substantial contributions to conception and design, acquisition of data, drafting the article, performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript, revised it critically for important intellectual content and final approval of the version to be published. Authors MNNH, HHKS and ALA performed the statistical analysis, wrote the first draft of the manuscript, equally managed the analyses of the study and equally contributed the literature searches. Authors MA, KLP and SM equally managed data collection, data analysis and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: The main cause of overweight and obesity is the imbalance between energy intake and expenditure. Obesity is the abnormal accumulation of ≥20% of body fat, over the individual's ideal body weight. Obesity is diagnosed by measuring the weight in relation to the height of an individual, thereby determining or calculating the body mass index (BMI).

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Methodology: This study is a cross-sectional study with the secondary data analysis of the health records of the patients who had attended the medical camps conducted in Melaka, Malaysia. All of the attendee's body weight and height were measured. The blood pressure measurement was done according to the Clinical Practice Guidelines, Ministry of Health, Malaysia. Hypertension is defined as if the participant has systolic blood pressure (SBP) of ≥ 140 mmHg and/ or diastolic blood pressure (DBP) of 90 mmHg or more. Some peoples were taking treatment of Hypertension.
Results: The mean SBP among females was 11.64 units and mean DBP was 5.29 units lower compared to male participants. With an increase in age, SBP is expected to increase by .29 units, provided other variables remain unchanged. Regarding to BMI, every unit increase in BMI, SBP increased by 1.99 units and DBP increased by .86 units provided other variables remain unchanged.
Conclusion: This study found that BMI is associated with SBP and DBP, which suggested that interventions for bodyweight management might be beneficial for the management of hypertension.

Keywords: Obesity; hypertension; renin-angiotensin system; body mass index.

1. INTRODUCTION

Overweight is a body mass index between 25.0 to 29.9 kg/m^2 [1]. Obesity is a body mass index of 30 kg/m^2 or higher [1]. The value of BMI is now used to diagnose the stage of overweight or obesity thereby fixing at 25.9–29 the limited BMI considered as overweight, while a BMI >30 constitutes obesity [2]. According to the World Health Organization (WHO), in 2005, approximately 1.6 billion adults over the age of 15 were overweight [3]. At least 400 million adults were considered obese and ≥20 million children under the age of 5 years were overweight. The estimation for the year 2015 is approximately 2.3 billion overweight adults and over 700 million obese ones [4]. Obesity is becoming increasingly prevalent, more on cardiovascular diseases, the leading cause of mortality worldwide [5].

Obesity is one of the risk factors for hypertension, dyslipidaemia, and diabetes mellitus [6]. The Framingham Study showing that both men and women had Hypertension with increased body weight [7]. Insurance industry data have also shown a positive relationship between overweight and hypertension [8].

Body mass index i.e. has a positive association with hypertension and so with morbidity and mortality from hypertension, cardiovascular disease, type II Diabetes mellitus, and other chronic diseases [9,10]

BMI (Body Mass Index) has become a standard tool for the measurement of obesity and overweight. Obesity is the result of accumulated fat in the body, 20% more weight than the standard weight is considered as obesity.

The prevalence of overweight and obesity is increasing, and obesity is estimated to be a leading cause of mortality and morbidity, causing an estimated 2.6 million deaths worldwide [11].

The issue of overweight and obesity has become a serious public health concern throughout the world during the last few decades. BMI is strongly associated with hypertension. Overweight is one of the major predisposing factors for hypertension. For the Asian population, an adult with a BMI of more than 23 is considered to be at the moderate to high risk of cardiovascular diseases [12].

2. METHODS

This study was the secondary data analysis of the participants' health camp screening data, which was organized in the Chinese community, Melaka, Malaysia. Health camp attendees age 18 years and above, both genders, living in Melaka were included in the data analysis. Meanwhile, pregnant women and children's data were excluded in this study. The participants' demographic information was collected with a form, weight, and height were measured, and BMI was calculated. The BMI were categorized as underweight (<18.5 kg/m^2), normal weight (18.5-22.9 kg/ m^2), overweight (23-24.9 kg/ m^2), and obese (≥ 25 kg/m^2) by using the WHO recommended cut off value for BMI for Asian-Pacific population [13]. The participants' blood pressure was measured following the Clinical Practice Guidelines (CPG); Management of Hypertension (MOH, 2018) [14]. The clinical practice guidelines of Malaysia the management of hypertension recommended to categorize the blood pressure 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)' [14].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 hypertensive[14].

The data were entered into Microsoft Excel spreadsheet and analysis was carried out by using the PASW Statistics for Windows, Version 18.0 (SPSS Inc., Chicago, USA). The demographic variables were analyzed by descriptive analysis; while reporting frequency, percentage, mean and standard deviation. The association between the categorical variables was tested with Chi-square test while a statistically significant level was set at p-value < .05.

3. RESULTS

In this study, 179 participants' health screening data were included. Approximately one-third of the participants were less than 40 years of age. Since the study was conducted in the Chinese community area, the majority (93.3%) were Chinese ethnicity. The mean SBP and DBP were 128.50 (SD ± 21.21) mmHg and 80.75 (SD ± 14.34) mmHg respectively. Meanwhile, approximately one-third of the participants (31.3%) had hypertension (Fig. 1).

Table 1. Demographic characteristics of participants (n=179)

Variables	Total n(%)	Underweight n(%)	Normal n(%)	Overweight n(%)	Obese n(%)
Age					
18-39 years	57 (31.8)	10 (17.5)	28 (49.1)	6 (10.5)	13 (22.8)
40-59 years	77 (43.0)	3 (3.9)	34 (44.2)	14 (18.2)	26 (33.8)
60-79 years	44 (24.6)	2 (4.5)	18 (40.9)	14 (31.8)	10 (22.7)
80 years and above	1 (.6)	0	1 (100)	0	0
Gender					
Male	73 (40.8)	5 (6.8)	30 (41.1)	11 (15.1)	27 (37.0)
Female	106 (59.2)	10 (9.4)	51 (48.1)	23 (21.7)	22 (20.8)
Ethnicity					
Chinese	167 (93.3)	13 (7.8)	79 (47.3)	32 (19.2)	43 (25.7)
Indian	11 (6.1)	2 (18.2)	2 (18.2)	1 (9.1)	6 (54.5)
Malay	1 (.6)	0	0	1 (100)	0
Blood pressure					
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
SBP	128.50 (21.21)	109.80 (13.14)	126.28 (19.94)	128.06 (17.30)	138.06 (23.06)
DBP	80.75 (11.80)	76.47 (14.34)	78.10 (10.91)	81.70 (10.50)	85.65 (11.75)

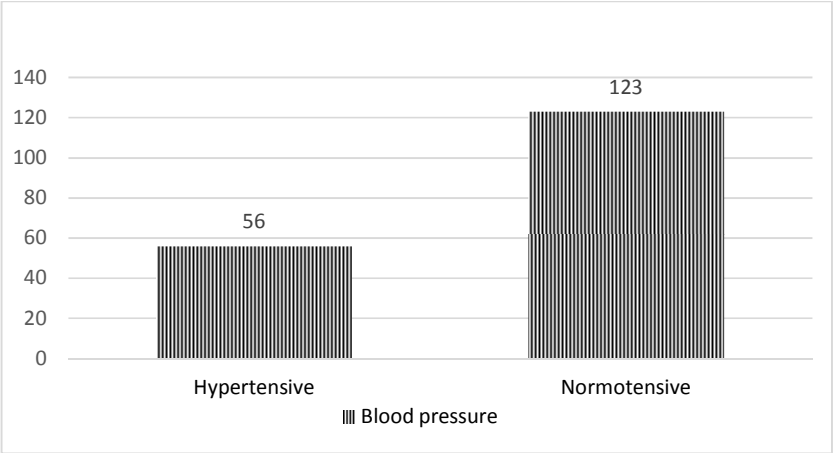

Fig. 1. Prevalence of hypertension among participants (n=179)

The participants who had SBP of 140 mmHg and/ or DBP of 90 mmHg or who were previously diagnosed hypertension were categorized as hypertension [14]

General linear model (GLM) analysis was carried out to test the association between gender, ethnicity, age, BMI, and blood pressure. The mean SBP among females was 11.64 units and mean DBP was 5.29 units lower compared to male participants. The SBP was significantly associated with age (P .001) and BMI (P <.001). Meanwhile, DBP was significantly associated with BMI (P <.001). Every unit increase in age, SBP is expected to increase by .29 units, provided other variables remain unchanged. Regarding BMI, every unit increase in BMI, SBP increase by 1.99 unit, and DBP increase by .86 unit provided other variables remain unchanged (Table 2).

4. DISCUSSION

Obesity is result of an imbalance between energy intake and energy expenditure [15]. In our study, both systolic and diastolic blood pressure were significantly associated with BMI. Genetic is one of the factors for weight gain; however, previous findings have shown that a high intake of food and less physical activity may play a more significant role in the amount of weight gained [16,17]. A sedentary lifestyle, psychological depression, can also affect on weight gain [18]. Excessive weight is also defined by consuming an excess of calories as compared to those utilized by the body and stored as fat tissue [15] and result as abnormally higher levels of cholesterol in the blood (hypercholesterolemia) [19]. Depending on the balance between saturated and unsaturated fatty acids, it can immediately affect certain organs such as liver and kidney, concomitantly the formation of atherosclerosis [20]. Physical inactivity, smoking, stress, inflammation, and certain bacteria are also favouring the formation of atherosclerosis [21] and then blocking the blood flow of large arteries. Fat accumulation gradually increases to form a type of plaque until it reaches a narrowing or stenosis of the vascular wall [22] that can lead to morbidity [23,24] and sudden death [25].

High blood sugar and dyslipidaemia have been suggested to acutely stimulate peripheral α1 and β-adrenergic receptors thereby leading to the elevation of sympathetic activity and hypertension [26].

The renin-angiotensin system (RAS) is mainly involved in the development of hypertension [27]. Angiotensinogen production serves as a cause and effect of adipocyte hypertrophy and leads to elevation of blood pressure through the action of Ang II, which induces systematic vasoconstriction, direct sodium, and water retention and increased aldosterone production [28].

Table 2. General linear model analysis of age, BMI and blood pressure among participants (n=179)

Variables	B	SE	95% CI (Lower limit)	95% CI (Upper limit)	P value
Systolic Blood Pressure					
Constant	73.03	10.95	51.42	94.63	
Gender					
Male	Reference				
Female	-11.64	2.88	-17.33	-5.96	<.001
Ethnicity					
Indian	Reference				
Malay	23.87	19.14	-13.91	61.65	.214
Chinese	2.82	5.74	-8.52	14.16	.624
Age	.29	.09	.11	.46	.001
BMI (kg/m2)	1.99	.37	1.26	2.72	<.001
Diastolic Blood Pressure					
Constant	64.19	6.56	51.24	77.15	
Gender					
Male	Reference				
Female	-5.29	1.73	-8.8.70	-1.88	.003
Ethnicity					
Indian	Reference				
Malay	-4.39	11.47	-27.04	18.26	.703
Chinese	-4.51	3.44	-11.30	2.29	.193
Age	.09	.05	-.02	.19	.109
BMI (kg/m2)	.86	.221	.42	1.30	<.001

RAS activation may be a chronic elevation of sympathetic tone, causing renal vasoconstriction and renin-dependent chronic hypertension. High levels of plasma renin activity, plasma Ang II and aldosterone values were found in human obesity [29] in which a presynaptic potentiating effect was seen on the sympathetic neurotransmission in patients under sodium restriction [30], likely through hypothetical mechanisms including impaired function of baroreceptors sensitivity and higher levels of circulating free fatty acids, Ang II, insulin and leptin [31].

Elevated levels of free-fatty acids enhanced vascular α-adrenergic sensitivity and consequently the increase of α-adrenergic tone [32]. It also inhibits Na+, K+ ATPase, and the sodium pump raising vascular smooth muscle tone and resistance [33].

The association between BMI and hypertension in our study was that every unit increase in BMI, SBP increase by 1.99 unit, and DBP increase by .86 unit provided other variables remain unchanged. Therefore, reduction of body weight could be beneficial for the management of hypertension. The treatment of obesity itself requires deep lifestyle modifications aiming to reduce body weight, thereby consuming a low-calorie diet with a total of 500-1,500 or 500-1,200 calories for men or women, respectively. It is also included the restriction of salt intake and less intake of saturated fats and cholesterol with more consumption of water, fruits, fresh and raw vegetables, fish, lean meats, whole grain, with moderate and constant physical activity as well as adequate night sleep [34,35].

5. CONCLUSION

Obesity is a major risk for essential hypertension, diabetes, and other morbidities that contribute to the development of kidney disease because it mainly increases tubular reabsorption to impair pressure natriuresis and cause volume expansion via the activation of the Sympathetic Nervous System SNS and the RAS. Additionally, obesity causes cardiovascular and renal diseases through several mechanisms including hypertension, hyperglycemia, inflammation, dyslipidemia and atherosclerosis, which are disorders that can coexist, particularly in the presence of excess visceral fat to cause metabolic syndrome.

Therefore, the habit of regular diets with the content of plenty of fibre, Omega 3, good vegetable and animal proteins, antioxidants, less fat and sugar, vitamins, and regular exercise, are healthy practices allowing the body's nutritional signaling mechanisms to equilibrate to reference levels.

In our study, females had lower SBP and DBP than males. SBP associated with age and BMI. DBP associated with BMI. Since the study was conducted within a specific community, the generalization of the findings might be limited. Further larger studies are necessary to support this finding.

CONSENT AND ETHICAL APPROVAL

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 inthe study were required to initialize the informed consent form.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Cornier MA, Despres JP, Davis N, et al. Assessing adiposity. A scientific statement from the American Heart association. Circulation. 2011;124:1996-2019. DOI: 10.1161/CIR.0b013e318233bc6a
2. Aronow WS, Fleg JL, Pepine CJ, et al. ACCF/AHA 2011 expert consensus document on hypertension in the elderly: A report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents. Developed in collaboration with the American Academy of Neurology, American Geriatrics Society, American Society for Preventive Cardiology, American Society of Hypertension, American Society of Nephrology, Association of Black Cardiologists and European Society of Hypertension. J Am Coll Cardiol. 2011;57:2037-114. DOI: 10.1016/j.jacc.2011.01.008

3. Gill T, King L, Caterson I. Obesity prevention: Necessary and possible a structured approach for effective planning. Proc Nutr Soc. 2005;64:255–261. DOI: 10.1079/PNS2005425
4. O'Connor DW. The impact of obesity on national and homeland security. Naval Postgraduate School; Monterey, CA; 2013.
5. Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: Global burden of disease study. Lancet. 1997;349:1269–1276. DOI: 10.1016/S0140-6736(96)07493-4
6. Kitahara CM, Flint AJ, de Gonzalez A. Berrington, Bernstein L, Brotzman M, MacInnis RJ, Moore SC, Robien K, Rosenberg PS, Singh PN, et al. Association between class III obesity (BMI of 40-59 kg/m^2) and mortality: A pooled analysis of 20 prospective studies. PLoS Med. 2014;11:e1001673. DOI: 10.1371/journal.pmed.1001673
7. Higgins M, Kannel W, Garrison R, et al. Hazards of obesity--the Framingham experience. Acta Med Scand. Suppl. 1988;723:23-36.
8. Harsha DW, Bray GA. Weight loss and blood pressure control (pro). Hypertension. 2008;51:1420-5. DOI:10.1161/HYPERTENSIONAHA.107.094011
9. Pi-Sunyer FX. Medical hazards of obesity. Ann Intern Med. 1993;119:655-60.
10. Jee SH, Sull JW, Park J, et al. Body-mass index and mortality in Korean men and women. N Engl J Med. 2006;355:779-87.
11. Majid Ezzati, Martin H, Skjod S, Hoorn SV. Trends in national and state-level obesity in the USA after correction for self-report bias: Analysis of health surveys. J R Soci Med. 2006;99:250-7.
12. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363:157-63.
13. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies [published correction appears in Lancet. 2004;363(9412):902]. Lancet. 2004;363(9403):157-163. DOI: 10.1016/S0140-6736(03)15268-3
14. MOH. Clinical Practice Guidelines, Management of Hypertension (5th Edition). Ministry of Health, Malaysia; 2018.
15. Rosenbaum M, Leibel RL. The physiology of body weight regulation: Relevance to the etiology of obesity in children. Pediatrics. 1998;101:525-539.
16. Racette SB, Deusinger SS, Strube MJ, Highstein GR, Deusinger RH. Weight changes, exercise and dietary patterns during freshman and sophomore years of college. J Am Coll Health. 2005;53: 245-251.
17. Nestle M, Jacobson MF. Halting the obesity epidemic: A public health policy approach. Public Health Rep. 2000;115: 12-24.
18. Mirowsky J, Ross CE. Social causes of psychological distress. Transaction Publishers, New Jersey, NJ; 2003.
19. Kwok CY, Wong CNY, Yau MYC, Yu PHF, Au ALS, Poon CCW, Seto SW, Lam TY, Kwan YW, Chan SW. Consumption of dried fruit of *Crataegus pinnatifida* (hawthorn) suppresses high-cholesterol diet-induced hypercholesterolemia in rats. J Funct Foods. 2010;2:179-186.
20. Ledwozyw A, Michalak J, Stepień A, Kadziołka A. The relationship between plasma triglycerides, cholesterol, total lipids and lipid peroxidation products during human atherosclerosis. Clin Chim Acta. 1986;155:275-283.
21. Ross R. Atherosclerosis - an inflammatory disease. N Engl J Med. 1999;340: 115-126.
22. Wong LK. Global burden of intracranial atherosclerosis. Int J Stroke. 2006;1: 158-159.
23. Taylor WC, Landau WM. Atherosclerosis and stroke. Ann Neurol. 1990;28:108-109.
24. Pico F, Labreuche J, Touboul PJ, Amarenco P. GENIC investigators: Intracranial arterial dolichoectasia and its relation with atherosclerosis and stroke subtype. Neurology. 2003;61:1736-1742.
25. Joki N, Hase H, Takahashi Y, Ishikawa H, Nakamura R, Imamura Y, Tanaka Y, Saijyo T, Fukazawa M, Inishi Y, et al. Angiographical severity of coronary atherosclerosis predicts death in the first year of hemodialysis. Int UrolNephrol. 2003;35:289-297.
26. Rocchini AP, Yang JQ, Gokee A. Hypertension and insulin resistance are not directly related in obese dogs. Hypertension. 2004;43:1011-1016.
27. Ferrario CM, Schiavone MT. The rennin-angiotensin system: Importance in physiology and pathology. Cleve Clin J Med. 1989;56:439-446.

28. Yiannikouris F, Karounos M, Charnigo R, English VL, Rateri DL, Daugherty A, Cassis LA. Adipocyte-specific deficiency of angiotensinogen decreases plasma angiotensinogen concentration and systolic blood pressure in mice. Am J Physiol Regul Integr Comp Physiol. 2012;302: R244-R251.
29. Tuck ML, Sowers J, Dornfeld L, Kledzik G, Maxwell M. The effect of weight reduction on blood pressure, plasma renin activity and plasma aldosterone levels in obese patients. N Engl J Med. 1981;304: 930-933.
30. Taddei S, Virdis A, Mattei P, Favilla S, Salvetti A. Angiotensin II and sympathetic activity in sodium-restricted essential hypertension. Hypertension. 1995;25:595-601.
31. Maser RE, Lenhard MJ. An overview of the effect of weight loss on cardiovascular autonomic function. Curr Diabetes Rev. 2007;3:204-211.
32. Stepniakowski KT, Goodfriend TL, Egan BM. Fatty acids enhance vascular α-adrenergic sensitivity. Hypertension. 1995;25:774-778.
33. Oishi K, Zheng B, Kuo JF. Inhibition of Na, K-ATPase and sodium pump by protein kinase C regulators sphingosine, lysophosphatidylcholine and oleic acid. J Biol Chem. 1990;265:70-75.
34. Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, Franklin B, Kris-Etherton P, Harris WS, Howard B, et al. American Heart Association Nutrition Committee: Diet and lifestyle recommendations revision 2006: A scientific statement from the American Heart Association Nutrition Committee. Circulation. 2006;114:82-96.
35. Mavanji V, Billington CJ, Kotz CM, Teske JA. Sleep and obesity: A focus on animal models. Neurosci Biobehav Rev. 2012;36: 1015-1029.

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