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Effect of Age and Gender on Correlation between Body Mass Index and Heart Rate among Hypertensive Patients

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ABSTRACT

Objective: Fatness is one of the main causes of mortality with elevated body mass index (BMI), especially from cardiovascular disease (CVD). Impaired or abnormal functioning of the autonomic nervous system has been involved in the progression of hypertension. Heart rate variability quantitatively evaluates cardiac autonomic disorder that is used to record reduced cardiac autonomic commotion in high blood pressurewith an age and gender. Our objective is to determine the effect of age and gender on correlation between body mass index and heart rate among hypertensive patients.

Methods: Secondary data analysis of a cross-sectional study on clinical manifestations of hypertensive patients was carried out. All patients in the parent study had self-reported history of hypertension where each patient's demographic profile and hypertension associated medical conditions had been recorded by interview while their blood pressure had been measured with the help of sphygmomanometer using stethoscope. Short-term heart rate variables were assessed using standard protocol. After cleaning, data of total 247 patients were used for final analysis -4using statistical package for social sciences version 20.

Results: The study results showed a significant positive correlation between body mass index and heart rate of the patients (ρ=0.288, p<0.001). Age based analysis of the correlation between body mass index and heart rate showed that it was significant only among older respondents i.e. patients aged 41 years or above (ρ=0.314, p<0.001) whereas gender based analysis of the correlation between body mass index and heart rate showed that it was significant among both male and female patients (ρ=0.341, p<0.001 and ρ=0.222, p<0.016 respectively).

Conclusion: Heart rate of the patients was found to be significantly correlated with their BMI. BMI of hypertensive patients could be used as an indication for presence of tachycardia among such individuals, especially those of advanced age.

Key words: Body mass index, Heart rate, Hypertension

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INTRODUCTION

The leading cause of mortality in patients is due to the obesity with elevated body mass index (BMI), particularly from cardiovascular disease (CVD) [1].

One study reported that although the consistent findings concluded that obesity is said to be the main cause of CVD, but the reason for these relationships are remained indistinct. As causes, various factors have been advocated for this association, such as resistance of insulin, decreased high-density lipoprotein, and hypertension, however, it has also been proposed that in obesity, a decrease in autonomic nervous system might be the cause of augmented incidence of CVD [2].

Preceding studies have acknowledged that the main reasons of hypertension are smoking, age, gender, exercise, dietary habits, family history, and body mass index (BMI) [3]. The incidence of obesity has been growing all over the world [4].

It is a significant risk factor in many chronic ailments such as dyslipidemia, hypertension, and diabetes mellitus type-2 [5]. High body weights are the main reasons of such types of disorders; therefore, due to its significance researches are actively being carried out [6].

One more study revealed that a systematic analysis confirmed that to achieve gold standards of health, comprising a normal BMI, was associated with lesser occurrence of both cardiovascular and non-cardiovascular illnesses [7]. The relationship between obesity and hypertension is multifaceted, considering the fact; hypertension that related to obesity is also closely allied with other ailments. At large, obesity is typically affected due to increased BMI, and it is one the major risk factors for hypertension [8] and the occurrence of hypertension intensifies with increasing BMI [9]. Though, BMI does not reproduce the distribution of body fats, and there is still some ambiguity about it. Correspondingly, there are concerns about its effectiveness to envisage the risk of hypertension and CVD [10].

Current researchers have focused on the autonomic system of the heart itself reported provocative verdicts [11]. The autonomic nervous system is basically a control system that works mainly mechanically and control shuman system for instance: Digestive system, heart rate, respiratory system, urination, pupillary response, and sexual arousal. It controls this system through the sympathetic and parasympathetic nervous systems [11].

Heart rate variability (HRV) measures the impact of autonomic activity on the heart itself [12]. Even a minor variability in autonomic nervous system of the heart changes the heart rate and rhythm. The HRV observes by way of beat-to-beat heart fluctuations and changes during recording of electrocardiogram (ECG). Hence, it might be the most beneficial and the easiest non-invasive technique to examine the effect of obesity on CVD [13].

It is essential to lay emphasis on the effect of obesity on HRV, as reduced HRV considerably raises cardiovascular death [14]. As the autonomic nervous system regulates an important part of body's internal functions, however, imbalance deposits of fats in the body in obesity is a negative factor. The chance of illnesses seems to have been risen due to the high quantity of deposit of fat contents in the body. For the determination of stratification of risk, it is appropriate to have cut-off values of fat content of a body based on its experimental relationship with disease [15]. The assessment of body fat is too intricate to be of applied clinical presentation. In researches sequences of anthropometric indices have been used to measure obesity, together with the BMI, circumference of waist, stature ratio of waist, and ratio of waist–hip. Amongst them, the BMI is used most extensively to classify obese, overweight, and underweight people [16].Therefore, our study is being carried out to determine the effect of age and gender on correlation between body mass index and heart rate among hypertensive patients.

MATERIALS AND METHODS

A cross sectional study on clinical manifestations of hypertensive patients was conducted in the department of a secondary care hospital of Karachi. Ethical approval was taken from the concerned department. A total of 247 patients having age up to 40 years and above for both the gender were recruited using convenient sampling technique. The study duration was based on 6 months starting from July, 2020 to December, 2020.All patients in the parent study had self-reported history of hypertension where demographic profile of each patient and their medical conditions associated with hypertension had been documented through interview while their blood pressure had been measured with the help of sphygmomanometer using stethoscope.

Short-term heart rate variables were assessed using standard protocol. As an exclusion criterion, the patients had gastrointestinal disease, neurological disorders, history of diabetes, cardiovascular diseases, cluster headache, and morbid obesity, were excluded from the study.

Once final cleaning, collected data of 247 patients were entered and analyzed by using statistical package for social sciences (SPSS) version 20. The descriptive data was represented as mean and standard deviation; however, qualitative data were communicated as percentages and frequency.

Stratification was used to control for the potential confounding effects of the age. After checking for normality, inferential investigation was done using Spearman correlation. Statistically significance level ofp-value was considered as $p<.05$.

RESULTS

A total of 247 participants were analyzed. Patients mean age were48 ± 12.55 years,74 (30.0%) of them were aged up to 40 years while 173 (70.0%) of them were aged 41 years or above; 130 (52.6%) were males while 117 (47.4%) were females; the mean body mass index of the patients were26.78 ± 5.65Kg/m2, whereas their mean heart rate was 94.10 ± 6.78 beats/min (Table 1). The study results showed a significant correlation between body mass index and heart rate of the patients ($\rho=0.288$, $p<0.001$) where they were found to be positively correlated with each other.

Age based analysis of the correlation between body mass index and heart rate showed that it was significant only among older respondents i.e. patients aged 41 years or above ($\rho=0.314$, $p<0.001$) where body mass index and heart rate was found to be positively correlated with each other while correlation between body mass index and heart rate among younger respondents i.e. patients aged up to 40 years ($\rho=0.201$, $p>0.086$) was insignificant, though still positively correlated.

Gender based analysis of correlation between body mass index and heart rate showed that it was significant among both male and female patients ($\rho=0.341$, $p<0.001$ and $\rho=0.222$, $p<0.016$ respectively) where body mass index and heart rate was found to be positively correlated with each other among both genders though the correlation was more significant among males than females (Table 2).

Table 1: Demographic Profile of the hypertensive patients.

Variable		Mean ± SD
		n(%)
Age (Years)		48 ± 12.55
Gender	Male	130(52.6)
	Female	117(47.4)
Age Group	Upto 40 Years	74(30.0)
	41 Years or Above	173(70.0)
BMI (kg/m2)		26.78 ± 5.65
Heart Rate (beats/min)		94.10 ± 6.78

Table 2: Correlation between BMI and heart rate.

Variable		Heart Rate (beats/min)	
		ρ	p-value
BMI (kg/m2)		0.288	<0.001
BMI (kg/m2)	Up to 40 Years	0.201	0.086
	41 Years and above	0.314	<0.001
	Males	0.341	<0.001
	Females	0.222	0.016

DISCUSSION

BMI is categorized as obese, underweight, overweight and normal. Obesity and overweight are the risk factors of several illnesses, as well as high BP [17].

Aging is also one of the reasons that effect on the prevalence of high BP [18]. The occurrence of high SBP improved throughout the age groups. The highest incidence of high BP was detected in the older age group i.e., 46 to 50 years. Further, out of 200 participants, the number of hypertensive patients who were 46 to 50 years of age was 32 (16.0%). The high rate of hypertension regarding age is caused due to the weak metabolic system of the kidney [19].As far as our study is concerned out of 247 hypertensive patients, 173(70.0%) patients with the age of 41 years or above revealing that older patients were more prone to develop hypertension.

A high occurrence with increased BP was witnessed in another study in which 65 (32.5%) participants were having hypertension i.e., SBP greater or equal to 140 mmHg. Among these participants, 35 (17.5%) were males and 30 (15.0%) were females suffering from hypertension [19].Another study reported that the high prevalence of hypertension in males against females might be as a result of modifications in living standards. Due to lifestyles modifications, men are at a greater risk of hypertension and its related diseases than women [20]. These findings are also comparable with our study to some extent showing that males were predominant over the females indicating 130(52.6%) males and 117(47.4%) females had hypertension and this is because of their lifestyles modifications.

Another cross sectional study was conducted amongst257 males of Tangkhul Naga of North-east India; their ages were from 20 to70 years presented BMI in different groups of age. Their mean BMI waswitnessed 22.3 kg/m2between 40 to49 years of age group. At the same time BMI was observed to be lowest among 20 to 29 years of age group and subsequently declined. It was further observed that differences in mean BMI were statistically significant between all the age groups a part from40 to 49& 50 to 59 years of age group. Mean BMI of all the age groups were found to be 20.9kg/m2 [21]. In light of our findings the mean BMI was found to be 26.78 ± 5.65kg/m2 and showed a positive correlation with a significant difference between BMI and heart rate with respect to age above 41 years in 173(70.0%) hypertensive patients (ρ=0.341, $p<0.001$) while positive correlation with an insignificant difference was observed between BMI and heart rate with respect to age up to 40 years in 74(30.0%) hypertensive patients (ρ=0.201, $p=0.086$).

In a study of above 30,000 young individuals, Baba et al. [22] have identified that resting heart rate (RHR) was genuinely related to obesity as well as average values of heart rate augmented along with the degree of obesity. A variety of substances are released by adipose tissue together with adiponectin, which may perhaps provide changes in the sympathetic nervous system and reduced parasympathetic nervous system, with increasing RHR values [23]. As far as our study is concerned, positive correlation with significant difference was observed between BMI and heart rate (ρ=0.288, $p<0.001$) showing that being overweight develops tachycardia in an individual.

Some more studies by some researchers reported that the resting pulse rate was found significantly higher in the obese group in association with the normal weight group. The rise in pulse rate was in compliance with the rise in mean heart rate of an individual [24].Moreover, a number of studies backed by the finding of tachycardia in overweight people, which is just because of different autonomic variations of the intrinsic heart rate [25-28]. Our results are similar too with the above mentioned studies illuminating that mean heart rate 94.10 ± 6.78 was observed along with increased BMI with hypertensive patients indicating tachycardia in higher BMI.

CONCLUSION

This study demonstrated that amongst hypertensive patients, heart rate was found to be significantly correlated with their BMI and closely associated with the age and gender. Inconsistency of heart rate quantitatively forms cardiac disorders in high blood pressure with an age and gender. Increased BMI of hypertensive patients might be used as assign for incidence of tachycardia among such individuals, specifically those of progressive age.

REFERENCES

1. Marie Ng, Fleming T, Robinson M. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the global burden of disease study 2013. Lancet 2014; 384:766–781.
2. Kaufman CL, Kaiser DR, Steinberger J, et al. Relationships of cardiac autonomic function with metabolic abnormalities in childhood obesity. Obesity 2007; 15:1164–1171.
3. Martín V, Dávila-Batista V, Castilla J, et al. Comparison of body mass index (BMI) with the CUN-BAE body adiposity estimator in the prediction of hypertension and type 2 diabetes. BMC Public Health 2015; 16:1-8.
4. Kuwabara M, Kuwabara R, et al. Different Risk for hypertension, diabetes, dyslipidemia, and hyperuricemia according to level of body mass index in Japanese and American subjects. Nutrients 2018; 10:1011.
5. Sun B, Shi X, Wang T, et al. Exploration of the association between dietary fiber intake and hypertension among U.S. Adults Using 2017 American college of cardiology/American heart association blood pressure guidelines: NHANES 2007—2014. Nutrients 2018; 10:1091.
6. Yang Y, Dong B, Zou Z, et al. Association between vegetable consumption and blood pressure, stratified by BMI, among Chinese adolescents aged 13-17 years: A national cross-sectional study. Nutrients 2018; 10:451.
7. Younus A, Aneni EC, Spatz ES, et al. A systematic review of the prevalence and outcomes of ideal cardiovascular health in US and Non-US populations. Mayo Clin Proc 2016; 91:649-70.
8. Kapetanakis VV, Rudnicka AR, Wathern AK, et al. Adiposity in early, middle and later adult life and cardiometabolic risk markers in later life. Findings from the British Regional Heart Study. PLoS One 2014; 9:e114289.
9. Lee CY, Lin WT, Tsai S, et al. Association of parental overweight and cardiometabolic diseases and pediatric adiposity and lifestyle factors with cardiovascular risk factor clustering in adolescents. Nutrients 2016; 8:567.
10. Pischon T. Commentary: Use of the body mass index to assess the risk of health outcomes: Time to say goodbye? Int J Epidemiol 2010; 39:528-9.
11. Tonhajzerova I, Javorka M, Trunkvalterova Z. Cardio-respiratory interaction and autonomic dysfunction in obesity. J Physiol Pharmacol 2008; 59:709–718.
12. Vanderlei LCM, Pastre CM, Hoshi RA, et al. Basic notions of heart rate variability and its clinical applicability. Rev Bras Cir Cardiovasc 2009; 24:205–217.
13. Rolim LC, de Souza JS, Dib SA. Tests for early diagnosis of cardiovascular autonomic neuropathy: Critical analysis and relevance. Front Endocrinol 2013; 4:173.
14. Laederach-Hofmann K, Mussgay L, Ruddel H. Autonomic cardiovascular regulation in obesity. J Endocrinol 2000; 164:59–66.
15. Hurt RT, Kulisek C, Buchanan LA, et al. The obesity epidemic: Challenges, health initiatives, and implications for gastroenterologists. Gastroenterol Hepatol 2010; 6:780–792.
16. Romero-Corral A, Somers VK, Sierra-Johnson J. Accuracy of body mass index to diagnose obesity in the US adult population. Int J Obes 2008; 32:959–966.
17. Truswell AS, Hiddink GJ, Blom J. Nutrition guidance by family doctors in a changing world: Problems, opportunities, and future possibilities. Am J ClinNutr. 2003; 77:1089S-1092S.
18. Pinto E. Blood pressure and ageing. Postgrad Med J 2007; 83:109–114.
19. Vuvor F. Correlation of body mass index and blood pressure of adults of 30–50 years of age in Ghana. J Health Res Rev 2017; 4:115-21.
20. Everett B, Zajacova A. Gender differences in hypertension and hypertension awareness among young adults. Biodemography Soc Biol 2015; 61:1–17.
21. Mungreiphy NK, Kapoor S, Sinha R. Association between BMI, blood pressure, and age: Study among Tangkhul Naga tribal males of Northeast India. J Anthropol 2011; 2011.
22. Baba R, Koketsu M, Nagashima M, et al. Adolescent obesity adversely affects blood pressure and resting heart rate. Circ J 2007; 71:722-6.

23. Vanderlei LC, Pastre CM, Freitas IF, et al. Geometric indexes of heart rate variability in obese and eutrophic children. Arq Bras Cardiol 2010; 95:35-40.
24. Yadav RL, Yadav PK, Yadav LK, et al. Association between obesity and heart rate variability indices: an intuition toward cardiac autonomic alteration: A risk of CVD. Diabetes Metab Syndr Obes 2017; 10:57-64.
25. Rabbia F, Silke B, Conterno A, et al. Assessment of cardiac autonomic modulation during adolescent obesity. Obes Res 2003; 11:541-8.
26. Freitas IM, Miranda JA, et al. Cardiac autonomic dysfunction in obese normotensive children and adolescents. Rev Paul Pediatr 2014; 32:244–249.
27. Nagai N, Matsumoto T, Kita H, et al. Autonomic nervous system activity and the state and development of obesity in Japanese school children. Obes Res 2003; 11:25–32.
28. Khrisanapant W, Sengmeuang P, Pasurivong O, et al. Does cardiac autonomic modulation exist in obese adolescents?.Srinagarind Med J 2008; 23:234–239.