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Original Article

The relation between obesity and hypertension

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Abstract

Aim: Hypertension is an emerging health problem related to cardiovascular disease, and many reports have shown the link between hypertension and obesity in different populations. In that study, we would like to evaluate the body fat accumulation type and obesity-related parameters with hypertension.
Material and Methods: Hypertensive and normotensive individuals were enrolled in Bandırma Training and Research Hospital, Cardiology Units. The cardiologist examined the demographic data, obesity-related parameters, and current health status. Blood pressures were measured under the European Heart Society Recommendations. The data was accepted statistically within the 95% confidence interval ($p<0.05$).
Results: The mean age of hypertensive and normotensive individuals was 60.25±12.45 vs. 57.78±11.17, p=0.05), respectively. A statistically significant increase was observed in BMI, waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR) status in hypertensive patients compared to controls. In contrast, hip circumference (HC) measurement is only higher only in hypertensive women than in normotensive (110.61±18.23 vs. 100.69±20.46; p:0.005), and there is no difference among men (108.56±16.16 vs107.93±16.78 p:0.82).
Conclusion: Abdominal weight gain is an important issue for cardiovascular disease; thus, waist circumference (WC) is essential to evaluate the hypertension risk more than obesity status. Hypertensive women are more prone to have apple-type body shapes than hypertensive men were pear body shapes. In conclusion, body fat accumulation is a more crucial triggering factor for hypertension than body fat.

Keywords: Hypertension, body fat, waist circumference, waist-to-hip ratio, Waist to height ratio

INTRODUCTION

Hypertension is defined as uncontrollable high blood pressure, which, if not treated, can cause many additional diseases, such as heart failure, left ventricular hypertrophy, hemorrhagic stroke, peripheral artery disease, aortic dissection, and heart valve diseases. In hypertension, the arterial blood pressure is above 140/90mm Hg when measured at repetitive intervals. The prevalence of hypertension is increasing all over the world. The prevalence of hypertension ranges from 15% to 30% in Europe, North America, and the Pacific Basin. Due to recent studies, Turkey has the highest prevalence of hypertension, at 37%. The first study investigating hypertension prevalence in Turkey was done by TEKKARF, which was started in 59 settlements in 1990 and calculated by taking the average of 2 blood pressures (1). This study was enlarged by examining the same cohort in 1995 and 1998 to investigate the Turkish population's change in blood pressure distribution over time. The relationship between hypertension, coronary heart disease, and morbidity has been studied (1,2).

Turkey's population over 20 is estimated to be 34 million. Women over the age of 20 have hypertension at 6 million, and male hypertension over the age of 20 is 5 million. The number of adults over 20 with hypertension is 11 million. According to this estimate, 35% of adult women have hypertension, and 30% of

adult men have hypertension. The prevalence of hypertension by age groups was calculated as in the age group of 30-39 is 20%; in the 50-59 age range as 50% where the prevalence is estimated at 70% over the age of 60 (2).

The cause of hypertension has not been clearly explained. When the cause of the disease is investigated, essential hypertension; It is known that it is caused by environmental factors (salt consumption, stressful structure, smoking, alcohol, sedentary life, obesity, NSAID use, etc.), disruptions in the renin-angiotensin-aldosterone system (RAAS), low birth weight and genetic predispositions or combinations of these factors. This study aims to highlight hypertensive patients' current situation and summarizes the current obesity situation in hypertension in older adults.

MATERIAL AND METHODS

Study Groups and Questionnaire

The patients and controls were enrolled from Bandırma Training and Research Hospital, Cardiology Units. The Clinical Research Ethics Committee approved the study with the decision dated 03/11/2021, numbered 2021-08. Our study was conducted under the Helsinki Declaration Principles. The study included 215 hypertensive patients and 140 normotensive healthy adults as the control group. For both groups, written consent from the participants was obtained at the beginning of the study. The questionnaire consists of 3 parts. The first part was about communication details, and the second part was about the current obesity situation; the third part investigated if there is any health problem.

Diagnosis of hypertension

Blood pressure was measured following the recommendations of the European Heart Society as the semi-flexed position at heart level on the right arm after 10min of rest). Hypertension levels were recorded as systolic (SBP), diastolic (DBP), mean arterial pressure (MAP), and heart rate.

Statistical Analysis

Statistical analysis was performed using the statistical package SPSS 18.0. The P-value below 0.05 was considered statistically significant. The association was determined by odds ratios (ORs) with 95% confidence intervals. Biological data are presented as mean ± SD for normally distributed variables, and an independent sample t-test was used to compare the normally distributed numeric variables. In contrast, the Mann-Whitney U test was used for non-normally distributed ones.

RESULTS

The mean age of hypertensive and normotensive individuals was 60.25±12.45 vs. 57.78±11.17, p=0.05), respectively. The mean age of the hypertensive patients was 62.96±13.27 in women and 58.68±11.53 in men. The mean age in healthy individuals was 51.56±9.52 in women and 61.15±10.59 in men among the normotensive group.

The hypertensive group had a greater BMI for both genders, and the results were as 30.95±5.08 vs. 27.32±8.37 in women (p:0.0027) while 29.44 ±3.73 vs. 27.35±4.15 in men (p:0.0029). The prevalence of overweight/obesity was 51.85 % in women and 45.31% in men in healthy control, while the rates were 45.45% in women and 17.02% in men among the hypertensive group.

Table 1. Descriptive Characteristics of Study Participants and Controls by gender

	Hypertensive Group			Normotensive Group		
	Women	**Men**	**Men**	**Women**	**Men**	**Total**
Age	62.96 ± 13.27	58. 68 ± 11.53	60.24 ± 12.44	51.56 ± 9.52	61.15 ± 10.59	57.77 ± 11.17
Alcohol Consumption	2.47 %	49.24 %	13.04%	14.89 %	67.5 %	8.82%
Smoking Status	17.28 %	46.96 %	38.18%	44.68 %	32.81 %	38.23%
Height	160.53 ± 5.70	171.93 ± 6.87	167.57 ± 8.50	160.39 ±5.60	172.62 ± 6.63	168.48 ± 8.55
Weight	79.70 ± 13.72	86.73 ± 13.70	84.05 ± 14.12	72.58 ± 26.81	81.89 ± 13.79	77.75 ± 18.93
BMI	30.95 ± 5.08	29.44 ± 3.73	29.29 ± 3.97	27.32 ± 8.37	27.35 ± 4.15	27.21 ± 5.46
Waist circumference (WC)	101.53 ± 24.65	104.59 ± 19.65	108.50 ±21.55	81.39 ± 19.21	96.66 ± 18.97	91.5 ± 20.37
Hip circumference (HC)	110.61 ± 18.23	108.56 ± 16.16	109.18 ± 16.71	100.69 ± 20.46	107.93 ± 16.78	105.48 ± 18.42
Waist-to-hip ratio (WHR)	0.92 ±0.18	0.97 ± 0.15	0.96 ± 0.17	0.82 ± 0.099	0.89 ± 0.020	0.85 ± 0.08
Waist to height ratio (WHtR)	0.63 ± 0.153	0.613 ± 0.12	0.60 ± 0.12	0.51 ± 0.12	0.55 ± 0.01	0.53 ± 0.11
Diastolic blood pressure (DBP)	79.68 ± 16.56	84.54 ± 13.08	82.67 ± 14.69	72.13 ± 9.43	80.02 ± 13.22	77.34 ± 12.64
Systolic blood pressure (SBP)	133.51 ± 20.71	136.47 ± 21.25	135.34 ± 21.08	114.17 ± 9.99	125 ± 19.32	121.34 ± 17.51

Note. SD, standard deviation; BMI, body mass index;; HC, hip circumference; WHR, waist-to-hip ratio; WHtR, waist to height ratio; SBP, systolic blood pressure; DBP, diastolic blood pressure; *p values are based on the comparison between hypertension and controls

A statistically significant increase was observed in body weight, waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR) status in hypertensive patients compared to controls. The waist circumference was significantly higher in hypertensive women than in healthy women (P<0.0001) while significantly lower in comparison among men (P=0.016). HC value is not significantly different between hypertensive and normotensive groups among men (p:0.005 in women and p: in men). Moreover, the waist-to-hip ratio (WHR) value is statistically significantly associated with hypertension in both genders (p.0.0006 and p<0.0001 for women and men, respectively). Together with Waist to height ratio (WHtR) is also a related risk factor for hypertension (p<0.001 in women and p:0.014 in men). The clinical characteristics of the hypertensive and controls are shown in Table 1.

In that study, we also examine the distribution of the body shapes between the groups. The body shapes allow understanding the local accumulation of fats, which is essential to evaluate heart-related risks. The people who were not overweight but with abdominal fat also have cardiovascular disease risk. The body shape distribution is shown in Table 2.

Table 2. Distribution of body shape among controls and hypertensive group

	Hypertensive Group			Normotensive Group			OR
Body Shape	**Women**	**Men**	**Total**	**Women**	**Men**	**Total**	
Apple	45.04 %	38.27 %	42.45%	21.74 %	38.18 %	38.23%	2.49 [95% CI 1.18-5.25] p:0.0165
Pear	32.82 %	43.21 %	36.79%	30.43 %	9.09 %	16.18%	5.10 [95%CI 2.13-12.25] p: 0.0003
Hourglass	5.34 %	14.81 %	11.79%	21.74 %	14.54 %	26.47%	1.05 [95%CI 0.41-2.66] p: 0.91
Inverted Triangle	16.79 %	3.70 %	8.96%	26.09 %	20 %	19.72%	1.00

DISCUSSION

The last WHO report indicates that 1.13 billion people have hypertension, and only 20% manage to control the disease (3). Hypertension is a multifactorial disease with different backgrounds such as genetic, environmental, demographic, lifestyle, vascular, and neuroendocrine-based problems; thus, etiology has not been linked directly to one factor.

The world's leading problem of obesity is not simple to explain, such as gain weight. Its directly related increase of the body's fat above the average rates causes many burden comorbidities. Many reports indicate that obesity triggers hypertension and vice versa. Thus, this is a ying-yang question in which one triggers another. It reduces excess weight and increases insulin resistance and blood pressure. Pediatric HT is becoming an epidemiological problem due to increased obesity in children and adolescents. (4,5). In addition, adolescents with primary hypertension are 15-20% more at metabolic syndrome risk (6). Flynn and Alderman have shown that prehypertensive children were younger and had lowered BMI compared to hypertensive children, and the obesity rate was 20% vs. %50, respectively. Our study compared the BMI and hypertension status among elderly people and found that BMI status is related to hypertension risk (7).

Sorof, body fat distribution is also directly linked with hypertension. Our study showed that apple-shaped individuals were 2.49 times, pear shape individuals were 5.10 times more prone to hypertension when compared to inverted triangle body shapes. In our study, no statistical difference was found between hourglass and inverted triangle body in the frame of hypertension risk (8).

Varady and colleagues have shown that systolic blood pressure can reduce by a short-term fasting period among overweight or obese individuals(9). Bhutani and colleagues clarified that reduction in adipose tissue-related parameters such as total cholesterol, LDL-C, and triacylglycerol concentrations among obese individuals after short-term fasting help to reduce blood pressure and hypertension risk within an 8-week diet (10).

Tawfik has shown that waist height ratio and waist circumference increase hypertension and cardiovascular risk for females. In contrast, the waist height ratio was a male risk predictor among elderly Egyptian individuals (11). Shrestha and colleagues have shown that BMI, waist-to-height ratio, and waist circumference are linked with hypertension and can use as a screening tool for hypertension in low-income countries (12). Our results are like these studies. Waist circumference (WC) and waist-to-height

ratio are linked with hypertension for both genders, while hip circumference (HC) is only associated with hypertension in females.

CONCLUSION

Our findings suggest that BMI level is higher in the hypertensive group, and obesity-related metabolic alterations may trigger hypertension. Our study showed that body fat accumulation and body shape are more significant risk factors than BMI. Our results demonstrated that apple and pear shape individuals are more prone to hypertension.

Conflict of interests

The authors declare that there is no conflict of interest in the study.

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Ethical approval

Yes we have done and state as The Clinical Research Ethics Committee of Çanakkale onsekiz Mart University was approved the study with the decision dated 03/11/2021, numbered 2021-08. Our study was conducted under the Helsinki Declaration Principles.

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