e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(1); 1352-1355

Original Research Article

Study of Correlation between Body Mass Index, Waist Hip Ratio, Blood Sugar and Blood Pressure in Young Adults in Mithilanchal Region

Rajiv Kumar Singh[1*], Mritunjay Kumar[2], Sheela Kumari[3]

[1]Tutor, Department of Physiology, Darbhanga Medical College & Hospital, Laheriasarai, Bihar
[2]Tutor, Department of Physiology, Darbhanga Medical College & Hospital, Laheriasarai, Bihar
[3]Professor and Head of Department, Department of Physiology, Darbhanga Medical College, Laheriasarai, Bihar

Received: 25-10-2023 / Revised: 23-11-2023 / Accepted: 26-12-2023
Corresponding Author: Dr. Mritunjay Kumar
Conflict of interest: Nil

Abstract:

Background: Global obesity is an epidemic that is becoming worse. An individual is considered obese if their body mass index (BMI) is 30 kg/m2 or more. It is one of the type 2 diabetes risk factors that can be changed. The purpose of this study was to ascertain the relationship between BMI, BP, and random blood sugar (RBS) in a group of young, healthy adults in Mithilanchal region.

Methods: There are 100 young people in this study, 46 of whom are male and 54 of whom are female, ranging in age from 18 to 30 during study period from May 2021 to November 2021. After a 10-minute rest interval, each subject's blood pressure was taken using a sphygmomanometer in their right arm. The individuals' blood pressure, waist-hip ratio, BMI, and random blood sugar levels are measured.

Result: The BMI averaged 26.26±3.34 kg/m^2. WHR averaged 0.91±0.24. RBS was 96.20±18.21 mg/dl on average. In comparison to individuals with normal WHR, both diastolic and systolic blood pressures increased dramatically in those with elevated BMI status and excessively raised WHR. Additionally, compared to individuals with normal WHR, those with raised WHR had considerably higher RBS.

Conclusion: In young adults, there is a favorable correlation between random blood pressure and blood sugar levels and elevated body mass index (BMI) and unusually elevated waist-hip ratio. As a result, young people everywhere run the danger of growing up to have chronic conditions like high blood pressure, type 2 diabetes, cancer, stroke, and other cardiovascular illnesses. Therefore, in order to stop the development of chronic diseases in the future, young people should have their BMI and waist-hip ratio regularly evaluated and maintained.

Keywords: Blood pressure, Body mass index, Obesity, Random blood sugar, Waist Hip ratio.

Introduction

Increased Body Mass Index (BMI) was one of the biggest increases in risk factor prevalence for hypertension, according to the Lancet's global burden of disease report for 2019.[1] A straightforward method for categorizing adult obesity is the body mass index. It is calculated by dividing a person's height in square meters by their weight in kilos. One of the main risk factors for the onset of chronic illnesses such as stroke, high blood pressure, Type 2 diabetes, and other cardiovascular conditions is obesity.[2] An imbalance between calories consumed and calories expended is the main cause of obesity. Global urbanization has led to a decrease in physical activity and an increase in the consumption of foods high in calories.[3]

Both the blood pressure and the BMI may rise as a result of dietary and lifestyle changes, stress, an inadequate diet, and inactivity.[4] Being overweight increases the likelihood of developing the metabolic syndrome, which raises the risk of coronary heart disease (CHD). Numerous studies have demonstrated that people with metabolic syndrome have an increased risk of developing type 2 diabetes.[5–10] An elevated BMI throughout childhood is also linked to a higher chance of developing CHD in later life.[11] Severely obese children and adolescents are prone to impaired glucose tolerance.[12] It has been shown that there are positive relationships between BMI and blood pressure (BP), body lipid levels, and glucose levels (fasting and random).[13, 14]

Despite being widely utilized, BMI has a lot of drawbacks. Age, gender, and ethnic characteristics all have an impact on BMI, which does not represent the distribution of body fat. Therefore, identifying anthropometric metrics that can detect body

fat, particularly the distribution of central body fat, will be crucial in determining the individuals who are genuinely at risk for cardiometabolic events. To provide a clearer image of the same, a number of metrics have been created, including the Waist Circumference (WC), Waist Hip Ratio (WHR), Body Adiposity Index (BAI), Body Shape Index (ABSI), and Abdominal Volume Index (AVI).

Uncertainty surrounds the process by which fat leads to insulin resistance. Numerous hormones, including resistin, free fatty acids, tissue necrosis factor, and leptin, are secreted by adipocytes.[15] It is believed that there is a favorable link between obesity and random blood glucose. The purpose of this study was to ascertain the relationship between BMI, BP, and random blood sugar (RBS) in a group of young, healthy Indian adults.

Material and Methods

The participants in this cross-sectional study, which included 100 young adults between the ages of 18 and 30 during study period from May 2021 to November 2021, were divided into 46 males and 54 females. The individuals' BMI, blood pressure, waist-hip ratio, and blood sugar levels are measured. After a 10-minute rest interval, each subject's blood pressure was taken using a sphygmomanometer in their right arm. After that, the blood pressure was categorized as normal at 140/90 mm Hg.

A weighing machine was used to determine the subject's weight in kilograms (kg). Without shoes, the subject's height was measured in centimeters. The formula for calculating BMI was to divide weight in kilograms by height in meters squared (kg/m2). The waist-hip ratio (W/H) is computed by dividing the waist measurement by the hip measurement. The measurement of the waist circumference was taken as the circumference of the abdomen at the midpoint of the anterior-superior iliac spine and the costal margins. At the level of the greater trochanters, the circumference of the hip was measured. Individuals were categorized as either normal or abnormal according to their Waist Hip ratio (WHR). WHR >0.8 for females and >0.95 for males was deemed abnormal. WHR≤0.8 for females and WHR≤0.95 for males were regarded as normal. Glucometers were used to measure blood sugar at random. The cutoff point was set at 130 mg/dl (7.7 mmol/l) of random capillary blood sugar. The collected data was combined, input into a spreadsheet using Microsoft Excel 2007, and exported to the SPSS version 15 data editor page (SPSS Inc., Chicago, Illinois, USA). The significance threshold and confidence level for each test were set at 5% and 95%, respectively.

Results

One hundred participants are analyzed in all. There are 46 men and 54 women among them. The subjects' average age was 25 years old. The BMI averaged 26.26±3.34 kg/m2. WHR averaged 0.91±0.24. Of the subjects, 125 exhibited abnormally high WHR (>0.95 for men and > 0.80 for women). 96.20±18.21 mg/dl was the mean RBS (Table 1). When these statistics were compared between males and females, it was found that while men had much higher WHR as would be predicted, females had significantly higher BMI. Women were found to have excessively high WHR compared to what is typical for their sex, but men tended to have WHR within normal ranges (Table 1).

Table 1: Gender wise distribution of mean values of risk factors

Variables	Male (n=92)	Female(n=108)	P value
Body mass index(BMI)	25.40±3.26	26.88±1.50	0.03*
Waist- Hip Ratio	0.92±7.2	0.90±0.1	0.001*
Random blood sugar	97.1±4.23	95.03±6.80	0.23
Systolic Blood pressure	127.90±12.62	125.09±09.57	0.42
Diastolic blood pressure	87.47±18.55	85.03±8.78	0.09

*Statistically significant P≤0.05. In comparison to individuals with normal WHR, both diastolic and systolic blood pressures increased dramatically in those with elevated BMI status and excessively raised WHR. Additionally, compared to individuals with normal WHR, those with raised WHR had considerably higher RBS. (Tables 2 and 3).

Table 2: Distribution of mean values risk factors according to BMI groups BMI Groups

Variable	BMI Groups				
	Underweight	Normal weight	Overweight	Obese	P value
Random blood sugar	87.45±14.20	92.10±10.48	99.12±13.48	106.02±04.23	0.002*
Systolic Blood pressure	106.88±12.30	112.90±11.10	123.45±14.36	137.06±15.24	0.001*
Diastolic blood pressure	71.05±11.14	75.31±7.24	77.09±4.34	81.11±22.78	0.003*

*Statistically significant P≤0.05

Table 3: Distribution of mean values risk factors according to WHR groups

Variable	Waist-Hip Ratio groups		P value
	Abnormal/Elevated	Normal	
Random blood sugar	110.14±20.15	101.98±18.22	0.001*
Systolic Blood pressure	135.86±24.22	119.34±18.10	0.001*
Diastolic blood pressure	85.95±34.12	73.78±27.34	0.001*

*Statistically significant P≤0.05.

SBP, DBP, RBS, and WHR all exhibited positive correlations with BMI, according to bivariate correlation analysis. Additionally, they correlated favourably with WHR. With the exception of the blood pressure (both systolic and diastolic), which did not correlate with RBS, the variables likewise exhibited a positive connection among themselves.

Discussion

The excessive buildup of fat in different body tissues that results in poor health is known as obesity. The development of chronic diseases such as stroke, hypertension, type 2 diabetes, cancer, musculoskeletal disorders, and other cardiovascular diseases later in life is primarily caused by obesity and elevated body mass index.[15] Diabetes mellitus and hypertension are two diseases that are associated with being overweight or obese. The majority of noteworthy studies on them have been conducted with communities in the West.[16–19] Asian populations have also been the subject of a few.[20–22]

According to our research, there is a strong association between waist-hip ratio and BMI for variables including blood pressure and random blood sugar. Blood pressure and blood sugar levels rise linearly with increases in BMI and waist-hip ratio. Increased stress levels, sedentary lifestyles, a lack of physical activity, urbanization, junk food consumption, and genetic factors may all contribute to this rise in BMI and waist-hip ratio. It has been shown that obesity raises the chance of developing diabetes, hypertension, kidney failure, and other cardiovascular conditions.[23]

Numerous factors can cause abnormal sodium retention and elevated blood pressure at the kidney level, including the activation of the sympathetic nervous system, the Renin-Angiotensin System, and an increase in aldosterone linked to obesity. Renal damage can also result from surrounding fat compressing the kidneys.[24] It has been shown that perivascular fat plays a significant part in the vascular events linked to obesity. One of the functions of the adipose tissue that surrounds blood vessels has been identified as vascular tone modulation.[25]

It has been shown that elevated levels of free fatty acids in the blood trigger the sympathetic nervous system, which raises blood pressure.[26] Elevated blood pressure in childhood is predictive of adult hypertension, according to a meta-analysis of longitudinal studies tracking blood pressure from childhood to adulthood.[27] Maintaining excellent health requires controlling risk factors like obesity, whose management can completely postpone or stop the onset of hypertension.

In this study, we revealed that elevated BMI and elevated waist-hip ratio were positively correlated with mean systolic blood pressure, diastolic blood pressure, and random blood sugar level in both genders. In a study conducted among urban school teenagers in the Lady Bhore Catchment Area of Bhopal City, the prevalence of pre-hypertension was 19.8% and the prevalence of hypertension among adolescents was 15.9%. The study also examined the related risk factors of hypertension.[28]

Conclusion

In young adults, there is a favorable correlation between random blood pressure and blood sugar levels and elevated body mass index (BMI) and unusually elevated waist-hip ratio. As a result, young people everywhere run the danger of growing up to have chronic conditions like high blood pressure, type 2 diabetes, cancer, stroke, and other cardiovascular illnesses. Therefore, in order to stop the development of chronic diseases in the future, young people should have their BMI and waist-hip ratio regularly measured and monitored. Young people need to be encouraged to lead stress-free lives, engage in regular exercise, eat healthily, and have a healthy lifestyle. One conclusion that can be drawn from this study and numerous others is that "prevention is better than cure." In order to guarantee preventative care, we must all work together to encourage the younger generation to engage in physical activities such as sports, exercise, and eating a well-balanced diet rather than indulging in junk food for palate pleasure.

References

1. De Venecia T., Lu M., Figueredo V. M. Hypertension in young adults. Postgraduate Medicine. 2016; 128(2):201–207.
2. World Health Organization Obesity: Preventing and Managing the Global Epidemic. Geneva, Switzerland: World Health Organization; 1997.
3. Hu F. Obesity epidemiology. Oxford: Oxford University Press; 2008.
4. WHO Global InfoBase team. Surveillance of chronic diseases and risk factors: Country level

data and comparable estimates. Geneva: World Health Organization; 2005.
5. Hanson RL, Imperatore G, Bennett PH, Knowler WC. Components of the "metabolic syndrome" and incidence of type 2 diabetes. Diabetes 2002; 51:3120–7.
6. Resmick HE, Jones K, Rutolo G, Jain AK, Handerson J, Lu W, et al. Insulin resistance, the metabolic syndrome, and risk of incident cardiovascular disease in non-diabetic American Indians. The Strong Heart Study. Diabetes Care 2003; 26:861–7.
7. Klein Be, Klein R, Lee KE. Components of metabolic syndrome and risk of cardiovascular disease and diabetes in beaver dam. Diabetes Care 2002; 25:1790–4.
8. Sattar N, Gaw A, Scherbakova O, Ford I, O'Reilly DS, Haffuer SM, et al. Metabolic syndrome with and without C-reactive protein as a predictor of coronary heart disease and diabetes in the west of Scot land. Coronary Prevention Study. Circulation 2003; 108:414–9.
9. Sattar N, Mc connachie A, Shaper AG, Blauw GJ, Buckley BM, De Crean AJ, et al. Can metabolic syndrome usefully predict cardiovascular disease and diabetes? Outcome data from two prospective studies. Lancet 2008; 371:1927–35.
10. Eckel RH, Grundy SM, Zimmet PZ. The metabolic syndrome. Lancet 2005; 365; 1415–28.
11. Baker JL, Olsen LW, Sorvusen T. Childhood body mass index and the risk of coronary heart disease in adulthood. N Eng J Med 2007; 357:2329–37.
12. Sinha R, Fisch G, Teague B, Tamborlane WV, Banyas B, Allen K, et al. Prevalence of impaired glucose tolerance among children and adolescents with marked obesity. N Eng J Med 2002; 346:802–10.
13. Pucarin-cvetkovil J, Mustajbegovic J, Jelinic JD, Senta A, Nola IA, Ivankovic D, et al. Body mass index and nutrition as determinants of health and disease in population of Croatian Adriatic islands. Croat Med J 2006; 47:619–26.
14. Turcato E, Bosello O, Di Francesco V, Harris TB, Zoico E, Bissow L, et al. Waist circumference and abdominal sagittal diameter as surrogates of body fat distribution in the elderly ;their relation with cardiovascular risk factors. Int J Obes Relat Metab Disord 2000; 24:1005–10.
15. Whitlock G, Lewington S, Sherliker P, Clarke R, Emberson J, Halsey J, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet. 2009; 373(9669):1083–96.
16. Grundy SM, Banett JP. Metabolic and health complications of obesity. Dis Mon 1990; 36:641–731.
17. Freedman DM, Ron E, Ballard-Barbash R, Doody MM, Linet MS. Body mass index and all-cause mortality in a nationwide US cohort. Int J Obes (Lond) 2006; 30:822–9.
18. Price GM, Uauy R, Breeze E, Bulpitt CJ, Fletcher AE. Weight, shape and mortality risk in older persons: elevated waist hip ratio, not high body mass index, is associated with greater risk of death. Am J Clin Nutr 2006; 84:449–60.
19. Pischon T, Boeing H, Hoffmann K, Bergmann M, Schulze MB, Overvad K, et al. General and abdominal adiposity and risk of death in Europe. N Engl J Med 2008; 359:2105–20.
20. Faheem M, Qureshi S, Ali J, Hameed, Zahoor, Abbas F, Gul AM, Hafizullah M. Does BMI affect cholesterol, sugar, and blood pressure in general population? J Ayub Med Coll Abbottabad 2010; 22(4).
21. Dudekula AB, Naik JL, Reddy KSN. Correlation between blood sugars and BMI with blood pressure among type 2 diabetic adults. Asian J. Exp. Biol. Sci. 2012; 3(2):378-383.
22. Vittal BG, Praveen G, Deepak P. A Study of body mass index in healthy individuals and its relationship with fasting blood sugar. Journal of Clinical and Diagnostic Research. 2010 December; 4:3421-3424.
23. Kamal Rahmouni, Marcelo L.G. Correia, William G. Haynes, Allyn L. Mark.Obesity-Associated Hypertension New Insights into Mechanisms .Hypertension. 2005; 45:9-14.
24. Hall JE. The kidney, hypertension, and obesity. Hypertension. 2003; 41: 625–633.
25. Verlohren S, Dubrovska G, Tsang SY, Essin K, Luft FC, Huang Y, Gollasch M. Visceral periadventitial adipose tissue regulates arterial tone of mesenteric arteries. Hypertension. 2004; 44:271–276.
26. Sironi AM, Gastaldelli A, Mari A, Ciociaro D, Postano V, Buzzigoli E, Ghione S, Turchi S, Lombardi M, Ferrannini E. Visceral fat in hypertension: influence on insulin resistance and beta-cell function. Hypertension.2004; 44:127–133.
27. Xiaoli Chen, Youfa Wang.Tracking of Blood Pressure from Childhood to Adulthood .A Systematic Review and Meta–Regression Analysis, Circulation. 2008; 117: 3171-3180.
28. Nisha Singh, Seema Patel, Dinesh K Pal, AngelinPriya. Prevalence of Hypertension and Associated Risk Factors among Urban School Adolescents in Lady Bhore Catchment Area of Bhopal City National Journal of Community Medicine, Volume 8, Issue 6, June 2017.315-319.