Original Research Paper

Volume - 16 | Issue - 08 | August - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Physiology

MPACT OF VISCERAL ADIPOSITY ON SYSTOLIC AND DIASTOLIC BLOOD PRESSURE: ASSESSING THE RISK OF HYPERTENSION IN AN URBAN POPULATION

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ABSTRACT **Background:** The rising global prevalence of hypertension is closely linked to the obesity epidemic. While general obesity is a known risk factor, the specific role of visceral fat accumulation in blood pressure elevation requires deeper investigation. Objective: To assess the changes in the blood pressure of study participants by measuring systolic and diastolic blood pressure, and to determine the connection between the accumulation of visceral fat and the risk of hypertension. Methods: A cross-sectional observational study was conducted involving 100 participants aged 20 to 40 years from the urban population of Prayagraj. Visceral fat was estimated using Bioelectrical Impedance Analysis (BIA) via an InBody 370S Body Analyzer. Systolic and diastolic blood pressure were measured using a Diamond Deluxe Sphygmomanometer. Statistical correlations were analyzed using SPSS version 20 and Pearson's correlation. Results: A significant positive correlation was observed between visceral fat accumulation and both systolic blood pressure ($r = 0.48$, $p = 0.001$) and diastolic blood pressure ($r = 0.44$, $p = 0.003$). Among the participants, 45% had elevated (high or very high) visceral fat levels, and 44% presented with either pre-hypertension or hypertension. Conclusion: Accumulation of visceral fat is a strong, independent predictor of elevated systolic and diastolic blood pressure in young adults. Targeted interventions to reduce visceral adiposity may significantly mitigate the risk of developing clinical hypertension.

KEYWORDS : Body mass index, visceral fat, hypertension, adiposity, blood pressure, systolic, diastolic

INTRODUCTION

Hypertension remains one of the most prominent modifiable risk factors for cardiovascular disease, stroke, and chronic kidney disease globally. Concurrently, the increasing rates of metabolic syndrome have highlighted the clinical significance of body fat distribution over mere absolute weight. While Body Mass Index (BMI) has traditionally been used to assess obesity, recent pathophysiological insights suggest that visceral adiposity—the accumulation of intra-abdominal fat—is highly metabolically active and uniquely contributes to systemic vascular changes.

Visceral adipose tissue functions as an endocrine organ, secreting various adipokines and inflammatory cytokines that induce endothelial dysfunction. Furthermore, visceral fat accumulation is known to overactivate the renin-angiotensin-aldosterone system (RAAS) and increase sympathetic nervous system activity, directly leading to sodium retention and vasoconstriction. This study aims to assess the changes in systolic and diastolic blood pressure among young urban participants to determine the explicit connection between visceral fat accumulation (measured via non-invasive bioelectrical impedance) and the risk of developing hypertension.

MATERIAL AND METHODS

Study Design and Population This study utilized a cross-sectional observational design. A total of 100 apparently healthy participants were recruited from the urban population of Prayagraj, near M.L.N. Medical College.

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Inclusion Criteria: Adults aged 20 to 40 years of any gender, providing informed written consent.

- Exclusion Criteria: Individuals with known cardiovascular disease, secondary hypertension, severe chronic illnesses, pregnant women, or those currently on long-term steroid medication.

Anthropometric and Visceral Fat Measurements Height and weight were recorded to calculate BMI. Visceral fat accumulation was assessed using Bioelectrical Impedance Analysis (BIA) with an InBody 370S Body Analyzer, taking advantage of multi-frequency segmental BIA technology.

Blood Pressure Measurement Resting blood pressure was measured using a validated Diamond Deluxe Sphygmomanometer. Measurements were taken in a seated position after 5 minutes of rest, with the arm supported at heart level. Two readings were taken 5 minutes apart, and an average was calculated for both Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP). Hypertension criteria were evaluated based on the NCEP ATP III guidelines.

Statistical Analysis Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 20. Continuous variables were expressed as mean ± standard deviation. The relationship between visceral fat area (VFA) and blood pressure was assessed using Pearson correlation coefficients (r). A p-value of < 0.05 was considered statistically significant.

OBSERVATION AND RESULTS

Visceral Fat Area (VFA) Distribution Visceral fat analysis showed that 55% of the participants maintained normal visceral fat levels (levels 1–9). However, a substantial 45% of the young adult cohort demonstrated elevated adiposity, as detailed in Table 1.

Table 1: Distribution of Visceral Fat Levels Among Participants (n = 100)

Table 1

Visceral Fat Level	Frequency (n)	Percentage (%)
Normal (1–9)	55	55%
High (10–14)	31	31%
Very High (15 or greater)	14	14%
Total	100	100%

Blood Pressure Findings Blood pressure categorization among the 100 participants revealed that while the majority maintained normal blood pressure, a concerning 44% fell into the pre-hypertension or hypertension categories (Table 2).

Table 2 Distribution of Participants Based on Blood Pressure Levels

Blood Pressure Category	Frequency (n)	Percentage (%)
Normal Blood Pressure	56	56%
Pre-Hypertension	29	29%
Hypertension	15	15%
Total	100	100%

Gender-wise comparison indicated slightly higher mean blood pressure values in males (n = 48) than females (n = 52), though these specific variations were not considered statistically significant ($p > 0.05$).

Table 3 Comparison of Blood Pressure Parameters According to Gender

Parameter	Male (n = 48) Mean ± SD	Female (n = 52) Mean ± SD	p-value
Systolic BP (mmHg)	124.6 ± 10.3	120.2 ± 9.4	0.062
Diastolic BP (mmHg)	81.5 ± 7.8	78.9 ± 7.2	0.084

3.3 Correlation Between Visceral Fat and Blood Pressure Pearson correlation analysis demonstrated a statistically significant relationship between the volume of visceral fat and blood pressure elevation. As visceral fat area increased, there were moderate, highly significant positive correlations with both systolic and diastolic blood pressure readings (Table 4).

Table 4 Correlation of Visceral Fat Area with Blood Pressure Parameters

Parameter	Correlation Coefficient (r)	p-value
Systolic Blood Pressure	0.48	0.001
Diastolic Blood Pressure	0.44	0.003

DISCUSSION

The findings of this study reinforce the critical link between intra-abdominal adiposity and vascular health, particularly in young urban adults. By actively measuring systolic and diastolic changes across varying levels of visceral fat, we established a clear trajectory of hypertension risk. The observation that 44% of the participants aged 20–40 years presented with pre-hypertension or clinical hypertension highlights an emerging cardiometabolic burden in this demographic.

The physiological mechanisms driving this connection likely involve the hyper-secretion of angiotensinogen by visceral adipocytes, leading to systemic vasoconstriction. Additionally, visceral fat-induced insulin resistance impairs the vasodilatory effects of nitric oxide on the vascular endothelium. Unlike subcutaneous fat, visceral fat's proximity to the portal circulation means its lipolytic products directly impact hepatic and systemic metabolic pathways. The statistically significant correlations between visceral fat area and both SBP ($p = 0.001$) and DBP ($p = 0.003$) firmly support the premise that clinical assessments of cardiovascular risk must prioritize visceral fat measurements alongside standard BMI monitoring.

CONCLUSION

This study concludes that there is a definitive, positive correlation between the accumulation of visceral fat and an increase in both systolic and diastolic blood pressure among young urban adults. Visceral adiposity, as measured reliably by bioelectrical impedance analysis, serves as a critical, independent predictor for the development of hypertension. Clinical management and preventative public health strategies should aggressively target visceral fat reduction through diet, exercise, and lifestyle modifications rather than focusing solely on overall weight loss.

REFERENCES

1. Baretić, M., Reschner, A., & Planinc, I. (2019). Higher visceral fat rate estimated by bioelectrical impedance analysis increases risk for prehypertension in normal weight healthy adults. *The Journal of Clinical Hypertension*, *21*(4), 538–539. https://doi.org/10.1111/jch.13508 Cited by: 3
2. da Silva, A. A., do Carmo, J., Dubinion, J., & Hall, J. E. (2009). The role of the sympathetic nervous system in obesity-related hypertension. *Current Hypertension Reports*, *11*, 206–211. https://doi.org/10.1007/s11906-009-0036-3 Cited by: 218
3. Gómez-García, M., Torrado, J., Pereira, M., Bia, D., & Zócalo, Y. (2022). Fat-Free Mass Index, Visceral Fat Level, and Muscle Mass Percentage Better Explain Deviations From the Expected Value of Aortic Pressure and Structural and Functional Arterial Properties Than Body Fat Indexes. *Frontiers in Nutrition, 9.* https://doi.org/10.3389/fnut.2022.856198 Cited by: 9
4. Hall, J. E. (n.d.). The Kidney, Hypertension, and Obesity - American Heart Association Journals. Cited by: 1369
5. Hamasaki, H., & Hamasaki, Y. (2018). Comparison Between Two Methods of Bioelectrical Impedance Analyses for Measuring Abdominal Visceral Fat Tissue. *Journal of Endocrinology and Metabolism*, *8*, 76–78. https://doi.org/10.14740/jem518w Cited by: 3
6. Hsueh, W. A., & Wyne, K. (2011). Renin-Angiotensin-Aldosterone System in Diabetes and Hypertension. *The Journal of Clinical Hypertension*, *13*, 224–237. https://doi.org/10.1111/j.1751-7176.2011.00449.x Cited by: 218
7. Khan, Z. A. (n.d.). Change in the prevalence of prehypertension and hypertension among young Indians aged 15–24 years between 2015–16 and 2019–21: Insights from nationally representative surveys | PLOS One - Research journals. Cited by: 1
8. Kim, F., Pham, M., Maloney, E., et al. (2008). Vascular Inflammation, Insulin Resistance, and Reduced Nitric Oxide Production Precede the Onset of Peripheral Insulin Resistance. *Arteriosclerosis, Thrombosis, and Vascular Biology*, *28*, 1982–1988. https://doi.org/10.1161/atvbaha.108.169722 Cited by: 442
9. Manrique, C., Lastra, G., Gardner, M., & Sowers, J. R. (2009). The Renin Angiotensin Aldosterone System in Hypertension: Roles of Insulin Resistance and Oxidative Stress. *Medical Clinics of North America*, *93*, 569–582. https://doi.org/10.1016/j.mcna.2009.02.014 Cited by: 321
10. Mathieu, P. (n.d.). Visceral Obesity | Hypertension - American Heart Association Journals. Cited by: 760
11. Młynarska, E. (n.d.). Endothelial Dysfunction as the Common Pathway Linking Obesity, Hypertension and Atherosclerosis - MDPI. Cited by: 76
12. Muniyappa, R., Iantorno, M., & Quon, M. J. (2008). An Integrated View of Insulin Resistance and Endothelial Dysfunction. *Endocrinology and Metabolism Clinics of North America*, *37*, 685–711. https://doi.org/10.1016/j.ecl.2008.06.001 Cited by: 328
13. Nayak, A. P. (n.d.). Prevalence of Pre Hypertension and Risk Factors Among the Resident Doctors | European Journal of Cardiovascular Medicine. Cited by: 1
14. Packer, M. (n.d.). Causal role of adipose tissue-derived adipokines in the pathogenesis of heart failure with preserved ejection fraction: experimental demonstration as the basis for clinical targeting - Oxford Academic. Cited by: 5
15. Parikh, S. (n.d.). Relationship Between Visceral Fat and Blood Pressure in Indian Adolescents - NICPD. Cited by: 3
16. Petřeková, K., Borzenko, N., Kovalová, M., & Gottfriedová, N. (2024). Assessment of Body Mass Index, Body Composition, Physical Activity, and Dietary Preferences in University Students: A Pilot Study. *Obesities*, *4*, 35–44. https://doi.org/10.3390/obesities4010004 Cited by: 24
17. Rani, R., Kannaujiya, A. K., Talukdar, P., & Sikarwar, A. (2022). Gender and rural-urban differences in hypertension among youth in India: Insights from a large scale survey, 2015-16. *Journal of Biosocial Science*, *55*, 523–537. https://doi.org/10.1017/s0021932022000141 Cited by: 9
18. Sun, Y., Lin, X., Zou, Z., et al. (2025). Association between visceral fat area and metabolic syndrome in individuals with normal body weight: insights from a Chinese health screening dataset. *Lipids in Health and Disease*, *24*. https://doi.org/10.1186/s12944-025-02482-0 Cited by: 20
19. Xu, Z., Liu, Y., Yan, C., et al. (2021). Measurement of visceral fat and abdominal obesity by single-frequency bioelectrical impedance and CT: a cross-sectional study. *BMJ Open*, *11*, e048221. https://doi.org/10.1136/bmjopen-2020-048221 Cited by: 102
20. Yilmaz, A. (n.d.). Role of certain adipokines in the pathophysiology of hypertension - Frontiers. Cited by: 1