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More than Weight: Visceral Fat's Role in Blood Pressure Elevation

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Abstract

Background: Hypertension is a major cardiovascular risk factor. Visceral fat is increasingly recognized for its metabolic and vascular impacts.

Objective: To examine the association between visceral fat and hypertension and compare visceral fat levels in hypertensive and non-hypertensive individuals.

Methods: Cross-sectional study among 262 adults aged 18–59 years at a primary care clinic. Visceral fat was measured using bioelectrical impedance analysis. Hypertension was identified through clinic records and diagnostic criteria. Data were analyzed using chi-square, t-tests, Pearson correlation, and ANOVA.

Results: Among 262 respondents, 50% were hypertensive. The mean visceral fat quantity was significantly higher in the hypertensive group (14.1) compared to the non-hypertensive group (8.8), with a p-value less than 0.001. Males had higher visceral fat levels than females in both groups ($p<0.001$), while age showed no significant association. A strong positive correlation was observed between BMI and visceral fat in both hypertensive and non-hypertensive populations ($r > 0.89$; $p<0.001$).

Conclusion: Visceral fat is strongly associated with hypertension.

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Targeted public health strategies to reduce visceral fat could mitigate hypertension risk.

Key Words: Hypertension, visceral fat, obesity.

أكثر من مجرد وزن

دور الدهون الحشوية في ارتفاع ضغط الدم

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المقدمة: يُعد ارتفاع ضغط الدم عامل خطر رئيسي لأمراض القلب والأوعية الدموية. وتزداد أهمية الدهون الحشوية نظرًا لتأثيرها على عمليات الأيض والأوعية الدموية.

الهدف:

دراسة العلاقة بين الدهون الحشوية وارتفاع ضغط الدم، ومقارنة مستويات الدهون الحشوية بين الأفراد المصابين وغير المصابين بارتفاع ضغط الدم.

المنهجية:

دراسة مقطعية شملت 262 بالغًا تتراوح أعمارهم بين 18 و59 عامًا في عيادة رعاية أولية. تم قياس الدهون الحشوية باستخدام تحليل المعاوقة الكهربائية الحيوية. تم تحديد ارتفاع ضغط الدم من خلال سجلات العيادة والمعايير التشخيصية المعتمدة. تم تحليل البيانات باستخدام اختبار كاي تربيع، واختبار (t) ، ومعامل ارتباط بيرسون، وتحليل التباين (ANOVA).

النتائج:

من بين 262 مشاركًا، كان 50٪ منهم مصابين بارتفاع ضغط الدم. وكان متوسط كمية الدهون الحشوية أعلى بشكل ملحوظ في مجموعة المصابين بارتفاع ضغط الدم (14.1) مقارنةً بغير المصابين (8.8)، مع قيمة (p) أقل من (0.001). كما أظهرت النتائج أن الذكور لديهم مستويات دهون حشوية أعلى من الإناث في كلا المجموعتين ($p<0.001$) ، في حين لم يظهر العمر ارتباطًا ذا دلالة إحصائية. وُجد أيضًا ارتباط إيجابي قوي بين

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مؤشر كتلة الجسم (BMIوالدهون الحشوية في كلا المجموعتين ;0.89 < r). p<0.001)

الخاتمة والتوصيات:

هناك ارتباط قوي بين الدهون الحشوية وارتفاع ضغط الدم. يمكن أن تساهم استراتيجيات الصحة العامة الموجهة لتقليل الدهون الحشوية في الحد من خطر الإصابة بارتفاع ضغط الدم.

الكلمات الدالة: ارتفاع ضغط الدم، الدهون الحشوية، السمنة.

1- Introduction

Visceral fat has emerged as a critical determinant of cardiometabolic risk beyond overall body weight. Unlike subcutaneous fat, visceral fat surrounds internal organs and actively secretes adipokines and inflammatory mediators that influence vascular function, insulin sensitivity, and blood pressure regulation [1,2]. While body mass index (BMI) is commonly used to assess obesity, it does not differentiate between fat distribution, limiting its predictive value for cardiovascular risk [3,4]. Evidence suggests that visceral fat accumulation may contribute directly to hypertension through mechanisms including increased sympathetic activity, renin-angiotensin-aldosterone system activation, and endothelial dysfunction [5]. Sex, age, and ethnicity further modify the relationship between visceral fat and blood pressure [6,7]. Understanding the relationship between BMI, visceral fat, and blood pressure is essential to clarify whether BMI alone can serve as a surrogate for visceral adiposity in hypertensive risk assessment. This study investigates the correlation between BMI and visceral fat in hypertensive and normotensive individuals to determine the extent to which BMI reflects visceral fat and its potential role in blood pressure elevation [1,2].

2- Methods

Design and Setting

Cross-sectional study from July to August 2018 at a primary clinic.

Participants

Adults aged 18–59 years attending outpatient clinic. Convenience sampling was used. Excluded: pregnant/lactating women, alcohol/tobacco users, DM/cancer patients, incomplete records, and those declining consent.

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Measurements

Visceral fat levels, weight, and BMI were measured using the Omron Karada Scan Body Composition Monitor (HBF-375). Height was measured using a GTE stadiometer. Blood pressure values were obtained from patient records. A visceral fat level of ≤9.5 was considered normal, 10–14.5 as high, and ≥15 as very high. All measurements were taken using the same instruments throughout the study to ensure consistency and reliability.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 30. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic and clinical variables. Chi-square tests assessed associations between categorical variables, such as visceral fat levels and hypertension. Independent t-tests compared means between two groups (e.g., visceral fat by gender or hypertension status). Pearson's correlation was used to assess the relationship between continuous variables like BMI, age, and visceral fat. One-way ANOVA was applied to compare visceral fat across multiple BMI categories. A p-value of less than 0.05 was considered statistically significant.

3- Results

1. Respondent Characteristics

A total of 262 individuals aged 18–59 years were included. Females made up 64.5% of the sample and Hypertension was present in 50% of respondents.

Table 1: Respondent Demographics and Clinical Characteristics

Characteristic	Entire Cohort (n=262)	Hypertensive (n=131)	Normotensive (n=131)
Age (mean ± SD)	41.0 ± 10.0	46.4 ± 7.6	35.4 ± 9.1
Female (%)	64.5	54.2	74.8
Systolic BP (mmHg)	128.3 ± 20.6	141.1 ± 19.1	115.5 ± 12.4
Diastolic BP (mmHg)	86.9 ± 12.9	95.0 ± 11.4	78.7 ± 8.4
BMI (mean ± SD)	—	—	—
Visceral Fat (mean)	—	14.1 ± 5.7	8.8 ± 6.1

2. Visceral Fat and Hypertension Association

There was a significant association between visceral fat quantity and hypertension. Hypertensive participants were more likely to fall into the high and very high visceral fat categories, while normotensive participants were more likely to have normal visceral fat levels.

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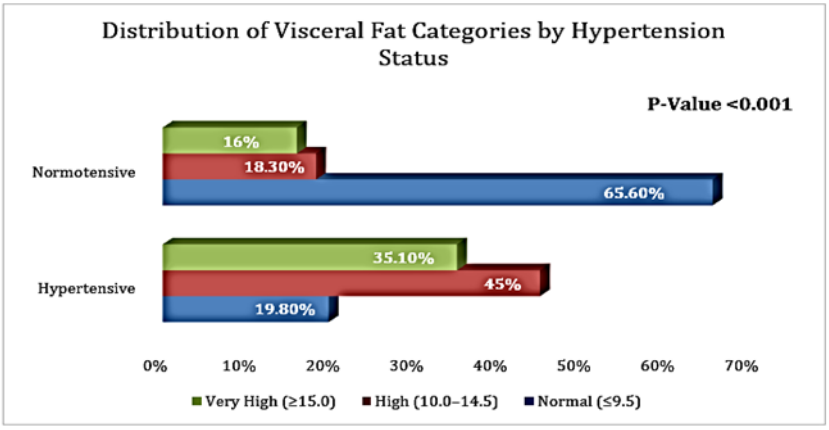
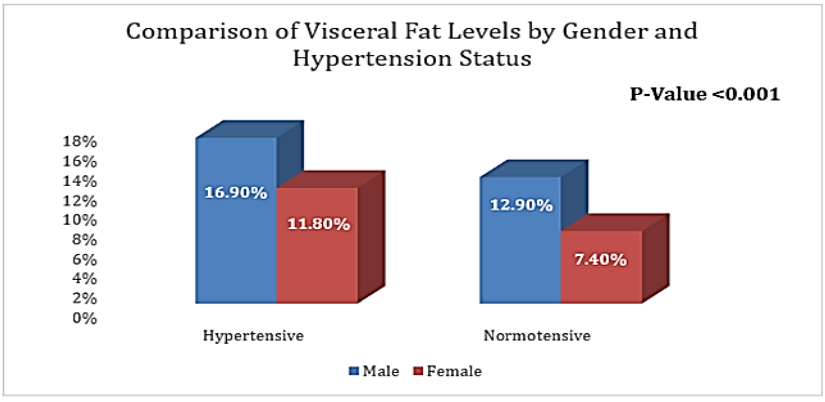


Figur1: Distribution of Visceral Fat Categories by Hypertension Status

3. Gender Differences in Visceral Fat

The analysis showed that visceral fat levels were higher in hypertensive participants compared to non-hypertensive participants across both genders. Furthermore, males demonstrated higher visceral fat values than females, regardless of hypertension status.



Figer2: Comparison of Mean Visceral Fat Levels by Gender and Hypertension Status

4. Age and Visceral Fat

The relationship between age and visceral fat was assessed using Pearson's correlation test. Among hypertensive participants, no significant association was observed ($r = -0.121$, $p = 0.170$). However, among normotensive participants, a weak but statistically

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significant positive correlation was found, suggesting that visceral fat increases with age ($r = 0.269$, $p = 0.002$).

5. BMI and Visceral Fat

The analysis demonstrated a strong positive correlation between BMI and visceral fat in both hypertensive and normotensive groups ($r = 0.890$ and $r = 0.895$, respectively; $p < 0.001$). This indicates that higher BMI values were consistently associated with higher visceral fat levels. The similar strength of the correlation across both groups suggests that BMI is a reliable predictor of visceral fat regardless of hypertension status.

Table 2: Visceral Fat Across BMI Categories

BMI Category	Hypertensive (VF Mean ± SD)	Normotensive (VF Mean ± SD)
Underweight	—	**1.4 ± 0.7**
Normal	**7.6 ± 2.6**	**4.7 ± 2.7**
Overweight	**12.3 ± 2.3**	**9.5 ± 2.9**
Obese	**19.4 ± 5.3**	**17.8 ± 6.3**

4- Discussion

This study demonstrates a strong link between visceral fat and hypertension. Among 262 participants aged 18–59 years, 50% were hypertensive and 64.5% were female. Hypertensive individuals were more likely to have high or very high visceral fat, whereas normotensive participants predominantly had normal visceral fat levels, supporting the role of visceral adiposity in blood pressure elevation [1,2,4,5].

Gender differences were observed, with males exhibiting higher visceral fat than females across both hypertensive and normotensive groups. Hypertensive participants of both genders had consistently higher visceral fat than their normotensive counterparts, highlighting the influence of visceral fat on hypertension risk and aligning with previous evidence on sex-related differences in fat distribution [8,9].

Age showed a weak but significant positive correlation with visceral fat among normotensive participants ($r = 0.269$, $p = 0.002$), consistent with age-related fat redistribution [10,11]. No significant correlation was observed among hypertensive participants,

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suggesting that visceral fat accumulation may have a stronger effect on blood pressure than age in this population.

BMI demonstrated a strong positive correlation with visceral fat in both hypertensive and normotensive groups ($r = 0.890$ and $r = 0.895$, $p < 0.001$), confirming that BMI reliably reflects visceral fat levels [3,4]. However, BMI alone cannot capture fat distribution, and individuals with similar BMI may have different visceral fat content, emphasizing the importance of direct visceral fat assessment for cardiometabolic risk evaluation.

These findings reinforce the role of visceral fat as a key determinant of hypertension. Incorporating visceral fat measurement alongside BMI could enhance risk stratification and guide interventions, including lifestyle modification and targeted therapies, to prevent or manage elevated blood pressure effectively [1,2,4,5].

Clinical Implications

These findings emphasize the importance of assessing visceral fat in routine clinical practice, especially for patients at risk of hypertension. While BMI is routinely measured, adding non-invasive tools like bioelectrical impedance analysis (BIA) can help identify patients with excess visceral fat who may otherwise appear healthy based on BMI alone.

The results suggest that public health initiatives should include visceral fat reduction strategies, particularly among high-risk subgroups like males and overweight individuals. These could include dietary changes, regular aerobic exercise, and targeted behavioral interventions. As shown in prior studies, modest weight loss and lifestyle modification can significantly reduce visceral fat and improve blood pressure control [11].

Strengths and Limitations

A key strength of this study is its practical setting—a government outpatient clinic—which enhances relevance to primary care settings. The use of a validated tool (BIA) and standardized protocols increases the internal consistency of results.

However, limitations include the use of convenience sampling, which introduces selection bias. The cross-sectional design

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precludes any causal inference. The sample was also heavily skewed towards female respondents, limiting the generalizability of gender and ethnicity findings. Finally, the exclusion of elderly patients and lack of data on confounding variables like physical activity, dietary intake, and socioeconomic status may have impacted the observed associations.

5- Conclusion and Recommendations

Visceral fat is a significant contributor to hypertension and cardiometabolic risk. This study confirms that individuals with higher visceral fat are more likely to be hypertensive, with males showing greater fat accumulation than females. BMI correlates strongly with visceral fat but does not fully capture fat distribution, highlighting the need for direct assessment of visceral adiposity. Clinicians should consider routine evaluation of visceral fat, particularly in patients with elevated BMI, to improve hypertension risk stratification. Targeted interventions, including lifestyle modification, dietary management, regular physical activity, and, when appropriate, pharmacologic therapy, are recommended to reduce visceral fat and associated cardiovascular risk.

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