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Assessment of Visceral Fat Thickness as an Individual Determinant of Metabolic Syndrome - A Cross-Sectional Single-Center Study

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Abstract: ***This cross-sectional single center study investigates and assess the visceral fat thickness as a single individual determinant of Metabolic syndrome. In this study we took consideration of the abdominal girth, HbA1C, hypertension as per the IDF criteria to compare with the VFT and its correlation. Conducted in a sample of 50 patients from April to July 2025 at the Department of Radiodiagnosis, MIMS, the study utilized Ultrasonography to measure these parameters, alongside demographic factors like BMI and sex, other laboratory investigations like HbA1C, lipid profile are obtained. Results indicate significantly higher VFT in high HbA1c and obesity patients ($p < 0.05$). These findings underscore the role of VFT in metabolic syndrome and diabetes, offering insights for potential early interventions to restore better metabolic health***

Keywords: Obesity, Visceral fat thickness, Metabolic syndrome, HbA1c, Ultrasonography

1. Introduction & Rationale

- Metabolic syndrome (MetS) is a cluster of metabolic and cardiovascular risk factors characterized by abdominal obesity, insulin resistance, hypertension and dyslipidaemia.[1,2]
- Prevalence of MetS is rising globally (~25% of adults) and affects ~30% of adults in India.[3]
- Abdominal obesity and visceral fat thickness (VFT) are strong predictors of MetS and type-2 diabetes.[4,5,6,7]
- Accurate quantification of VFT helps in early identification and management of metabolic risk. [8-11]
- Ultrasonography (USG) offers a reliable, radiation-free and cost-effective alternative for measuring VFT. [12]
- Previous studies demonstrate strong correlations between VFT measured on USG and metabolic syndrome and its components. [13,14]

2. Aim & Objectives

Aim

Primary Objective:
- To assess the relationship between visceral fat thickness and metabolic syndrome.

Secondary Objectives:
- To evaluate correlations of VFT with glycated hemoglobin (HbA1C), Body Mass Index (BMI), abdominal girth, and systolic blood pressure (SBP)
- To calculate the p value of these spinal parameters and its significance.

3. Methodology

Study design:
Cross sectional single centre study performed in a radiology department from April to July 2025 (4 months).

Sample: 50 adults (30 females, 20 males) aged 20–65 years.

Inclusion Criteria: Patients selected from routine health check ups and pts referred to radiology dept. from medicine OPD.

Exclusions: pregnancy, hepatic/renal disease, malignancy, chronic inflammatory disease or steroid therapy.

Assessments:
- Recorded demographics, BMI, abdominal girth (measured at midpoint between lower rib and iliac crest), systolic/diastolic blood pressure, total cholesterol, triglycerides.
- VFT measured by ultrasonography as distance between the rectus sheath and anterior wall of aorta. [11-13]
- HbA1C measured to assess glycemic status; classification into normal (<5.7%), prediabetic (5.7–6.4%) and diabetic (≥6.5%).[14-17]
- MetS diagnosed according to IDF criteria (central obesity plus ≥2 other components). [1,14,16]
- Statistical analysis is done using appropriate significance tests and results are evaluated.

4. Results

Abdominal girth: higher in females (108.95 ± 8.86 cm) vs males (99.91 ± 8.15 cm), **$p = 0.001$**.

Diastolic BP: higher in females (80.17 ± 3.46 mmHg) vs males (76.90 ± 2.36 mmHg), **$p < 0.001$**.

BMI and **Triglycerides** trend higher in females ($p = 0.066$ and $p = 0.064$ respectively) but don't cross 0.05.

Age, VFT, HbA1c, Systolic BP, Total Cholesterol: no significant sex difference ($p \geq 0.13$).

Metabolic syndrome prevalence: 40% in females (12/30) vs 30% in males (6/20)

5. Discussion

- VFT showed a strong positive correlation with BMI ($r = 0.66$, $p < 0.001$) and HbA1C ($r = 0.59$, $p < 0.001$), indicating that visceral adiposity parallels both overall adiposity and glycemic control.
- A moderate correlation between VFT and abdominal girth ($r = 0.31$, $p = 0.028$) suggests that ultrasonographically measured visceral fat adds information beyond simple waist circumference.
- Participants with metabolic syndrome had significantly higher BMI, visceral fat thickness and HbA1C levels than those without MetS ($p < 0.01$).
- No significant sex differences were observed in VFT or HbA1C, although women had greater abdominal girth and diastolic blood pressure.

6. Comparison & Context

- The prevalence of metabolic syndrome in our study (34%) is consistent with the reported 30% prevalence in Indian adults2.
- HbA1C levels retained the association between hyperglycemia and visceral adiposity, reinforcing it as a practical marker for cross-sectional assessments.
- Sex-specific differences in abdominal girth may reflect hormonal, behavioural and psychosocial factors noted in prior literature.
- Visceral fat thickness shows a clear positive association with metabolic-syndrome markers—particularly HbA1c and BMI—as evident in the upward trends on the VFT–HbA1c and VFT–BMI plots

Conflicts of Interest

This is a not a sponsored study and they are no conflicts of interest.

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7. Limitations

- Small sample size ($N = 50$) limits generalisability and reduces power for detecting weaker associations.
- Cross-sectional design prevents causal inference; longitudinal studies are needed to confirm predictive value of VFT.
- Dietary information and lifestyle factors were not collected, which could confound associations between visceral fat and metabolic biomarkers.

8. Conclusion

- VFT is a robust, non invasive predictor of metabolic syndrome and correlates strongly with BMI and glycaemic status even in our limited study sample.
- Ultrasonography can readily quantify visceral fat thickness in routine practice, offering an accessible tool for early risk stratification.
- Integrating HbA1C measurements alongside anthropometric and sonographic assessments provides a comprehensive metabolic risk profile.
- Future work should validate these findings in larger, ethnically diverse cohorts and incorporate lifestyle interventions.

9. Future Directions & Acknowledgements

- Expand sample size across multiple centres to improve statistical power and generalisability.
- Incorporate longitudinal follow-up to evaluate whether VFT predicts incident diabetes, hypertension and cardiovascular events.
- Collect dietary and physical activity data to control for lifestyle confounders and better understand mechanistic pathways.
- Evaluate the impact of targeted lifestyle or pharmacologic interventions on visceral fat reduction and metabolic outcomes.
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