ORIGINAL ARTICLE

Assessing Body Fat in Obesity: Clinic and Home Monitoring Using a Portable Bioelectrical Impedance Analysis Device

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Abstract

Introduction: With the rising burden of obesity in India, accurate assessment of body and visceral fat has become essential for risk stratification and monitoring treatment response, both in clinics and at home. Bioelectrical impedance analysis (BIA) offers a practical alternative to advanced imaging-based methods such as dual-energy X-ray absorptiometry (DEXA) or magnetic resonance imaging (MRI), which, while precise, are expensive and not widely accessible. Among BIA devices, the InBody 770 is regarded as a clinical reference standard, but its high cost and large size restrict routine use. Portable and affordable BIA devices provide a potential solution, but their accuracy requires validation against established methods.

Patients and methods: This cross-sectional study was conducted at the Fatty Liver and Obesity Clinic, Sir Ganga Ram Hospital, New Delhi, which manages patients with obesity, diabetes, and related metabolic disorders, including metabolic dysfunction-associated steatotic liver disease (MASLD). A total of 343 consecutive adults underwent body and visceral fat measurement using both the portable Omron HBF-702T and the InBody 770 devices. Agreement between the two devices was assessed using Pearson correlation coefficients and Bland–Altman plots, with subgroup analyses by gender and body mass index (BMI).

Results: The mean age of participants was 45 years, and 76.7% were male. Omron demonstrated excellent correlation with InBody 770 for total body fat percentage ($r = 0.91$). Subgroup analysis showed consistently high correlations in males ($r = 0.87$) and in patients with BMI ≥30 ($r = 0.90$). For visceral fat, Omron showed a good overall correlation ($r = 0.73$) but weaker performance in females ($r = 0.68$) and patients with BMI <30 ($r = 0.40$).

Conclusion: The portable BIA device Omron HBF-702T provides reliable estimates of total body fat, comparable to the InBody 770, in individuals with obesity and diabetes. Visceral fat estimation shows variability in certain subgroups, particularly females and those with lower BMI. Despite these limitations, the Omron remains a practical and affordable tool for routine monitoring in both clinics and homes, especially relevant in the era of lifestyle interventions and glucagon-like peptide-1 (GLP-1)-based therapies.

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Introduction

The prevalence of obesity and type 2 diabetes is rapidly increasing worldwide and in India, driving a parallel rise in related complications such as metabolic syndrome, cardiovascular disease, and metabolic dysfunction-associated steatotic liver disease (MASLD).[1–3] Excess fat accumulation, particularly visceral fat, plays a central role in these conditions.[4,5] Unlike subcutaneous fat, visceral fat is more metabolically active and is strongly linked to systemic inflammation, insulin resistance, and increased cardiometabolic risk.[4]

Traditionally, body mass index (BMI) has been used as a proxy to assess obesity and, by extension, the risk of metabolic diseases. However, BMI has limitations in accurately reflecting body fat distribution and metabolic health.[6,7] Recent guidelines therefore recommend more specific markers of abdominal adiposity, such as waist circumference, waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR), which correlate better with metabolic risk. Clinicians are also increasingly recognizing that targeting fat loss, especially visceral fat, is more important than weight loss alone in the management of obesity, diabetes, and MASLD.[8,9]

Accurate assessment of body composition is thus essential. While dual-energy X-ray absorptiometry (DEXA), magnetic resonance imaging (MRI), and computed tomography (CT) are considered gold standards for total and visceral fat measurement, their high cost, lack of portability, and need for specialized personnel limit their use in routine practice. Consequently, there is a growing need for accessible, cost-effective, and noninvasive methods to evaluate body composition in everyday healthcare settings.

Bioelectrical impedance analysis (BIA) machines have gained popularity for their ability to estimate body composition, offering a noninvasive and practical method for assessing both total body fat and visceral fat.[10] Among BIA devices, the InBody 770 is considered the gold standard, providing detailed body composition data with high precision.[10–13] It is a multifrequency BIA device manufactured by InBody Co., Ltd., headquartered in Seoul, South Korea. The InBody 770 provides measurements of total body fat percentage, skeletal muscle mass, visceral fat area, and segmental body composition, among other parameters. Its use of multifrequency electrical currents enhances its accuracy, particularly in assessing intracellular and extracellular water content, which is crucial for evaluating metabolic and health status in various clinical settings. However, its large size and high cost limit its accessibility, especially in smaller clinics or resource-constrained settings. On the other hand, portable devices like the Omron HBF-702T (Omron Corp., Kyoto, Japan), which are affordable and easy to use, could serve as viable alternatives for assessing body fat in overweight and obese patients.[5,14,15]

This study was conducted to evaluate the accuracy of the Omron HBF-702T compared with the InBody 770 for estimating total body fat and visceral fat in Indian patients with obesity, diabetes, and MASLD. We also assessed its performance across gender and BMI subgroups to determine its reliability in real-world clinical practice.

Patients and Methods

Patients

This cross-sectional study was conducted at the Fatty Liver and Obesity Clinic of the Institute of Liver, Gastroenterology and Pancreatico-Biliary Sciences (ILGPS), Sir Ganga Ram Hospital, New Delhi. The clinic, established in January 2024, caters to patients with obesity, diabetes, and metabolic dysfunction-associated conditions, including MASLD.

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Between January and December 2024, 343 consecutive patients attending the clinic were enrolled. Eligible participants were adults aged ≥16 years with obesity, diabetes, or MASLD. Patients with secondary causes of liver disease (viral hepatitis, autoimmune hepatitis, or significant alcohol use) were excluded.

All participants underwent a structured clinical evaluation, including detailed history, physical examination, anthropometric measurements, and review of medical records. Laboratory tests included liver function, lipid profile, and glycemic markers. Liver stiffness measurement (LSM) was performed to assess fibrosis stage where clinically indicated.

Body Fat and Visceral Fat Measurement by Omron HBF-702T

Body composition measurements were conducted using the Omron HBF-702T (Omron Corp., Kyoto, Japan), a BIA device, which measures total body fat percentage and visceral fat levels through an electrical signal that passes through the body with minimal discomfort. The device's specificity in detecting different fat compartments makes it suitable for regular clinical use. Measurements were standardized by ensuring that participants fasted for at least 4 hours and avoided strenuous exercise prior to the assessment.

Body Fat and Visceral Fat Measurement by InBody 770

Every patient underwent simultaneous body composition analysis using the InBody 770 (Cerritos, CA, USA), another advanced BIA device. It provides a detailed body composition analysis, including muscle mass and extracellular and intracellular water, which are crucial for assessing metabolic disorders in patients with obesity, diabetes, and liver disease. The InBody 770 is known for its high precision, making it the gold standard for comparison in this study. Similar to the Omron procedure, standardized conditions were maintained for accurate measurement.

Statistical Analysis

Statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics summarized baseline characteristics. Continuous variables were expressed as mean and standard deviation or median and interquartile range based on their distribution, while categorical variables were described using counts and percentages. Pearson correlation coefficients were calculated to assess the relationship between the body fat measurements from the Omron and InBody devices. Bland-Altman plots were used to evaluate the agreement between the two measurement techniques. Subgroup analyses were performed based on gender and BMI to investigate potential differences in measurement accuracy. A p-value of <0.05 was considered statistically significant. These methods were chosen because they are widely accepted for validating body composition devices in clinical research.

Results

Baseline Characteristics

Table 1 summarizes the baseline characteristics of the 343 participants. The mean age was 45 years (range, 16–81 years), with a predominance of males (76.7%). Most patients were overweight or obese, with 46.1% in the BMI 25.0–29.9 range and 32.1% in the 30.0–34.9 range. Indices of abdominal adiposity were strikingly high, with >96% of participants having elevated waist-to-height ratio, waist-to-hip ratio, or waist circumference, indicating a very high prevalence of central obesity. A large majority (75.4%) reported a sedentary lifestyle.

Table 1: Baseline characteristics

Characteristic	*Values (n = 343)*
Age (years)	45 (16–81)
Sex (*n*, %)	
Males	263 (76.7%)
Females	80 (23.3%)
BMI categories (*n*, %)	
<18.5	2 (0.6%)
18.5–22.9	11 (3.2%)
23.0–24.9	22 (6.4%)
25.0–29.9	158 (46.1%)
30.0–34.9	110 (32.1%)
≥35.0	40 (11.7%)
Abdominal adiposity indices (*n*, %)	
High WHtR (>0.5)	333/336 (99.1%)
High WHR [>0.9 (M), >0.85 (F)]	332/343 (96.8%)
High WC [>90 (M), >80 (F) cm]	324/336 (96.4%)
Lifestyle (*n*, %):	
Sedentary (<5,000 steps/day)	258/342 (75.4%)
Physically inactive (5,000–7,499 steps/day)	48/342 (14.0%)
Physically active (10,000–12,499 steps/day)	27/342 (7.9%)
Moderately active (7,500–9,999 steps/day)	9/342 (2.6%)
LSM categories (*n*, %)	
<8.2 kPa	172/297 (57.9%)
8.2–14.9 kPa	65/297 (21.9%)
≥15 kPa	60/297 (20.2%)
Diabetes status (*n*, %)	
No diabetes	142 (41.4%)
Prediabetes	65 (19.0%)
Diabetes	136 (39.6%)
Hypertension	131 (38.2%)
Dyslipidemia (*n*, %)	218 (63.6%)
Coronary artery disease (*n*, %)	16 (4.7%)
Fib-4	1.31 (0.10–12.21)
APRI	0.52 (0.01–4.6)
Omron body fat%	32.6 (15.2–47.6)
Omron visceral fat%	16.0 (1.5–30.5)
InBody body fat%	37.8 (16.0–56.8)
InBody visceral fat area (cm^2)	160.4 (41.8–272.6)

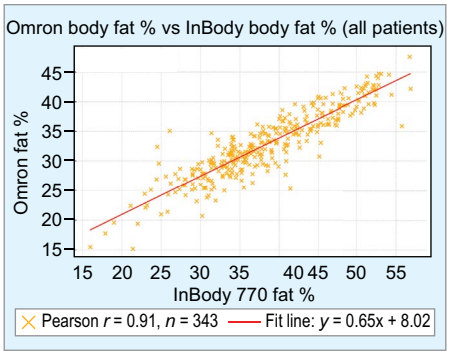
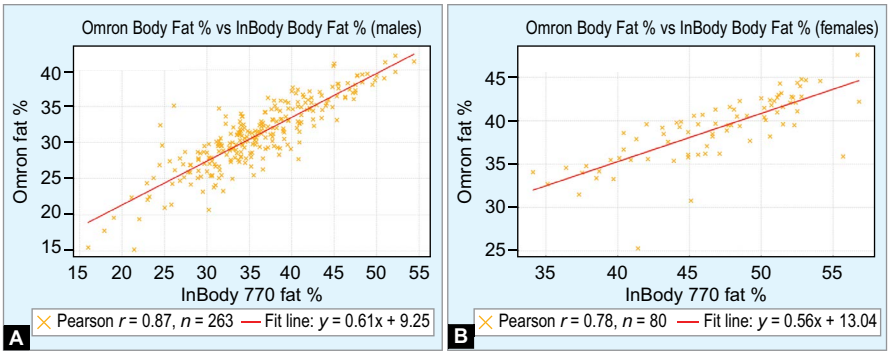


Fig. 1: Scatter plot comparing total body fat percentage measured by the portable Omron HBF-702T and the reference device InBody 770 in 343 patients. A strong correlation was observed between the two methods



Figs 3A and B: Scatter plots comparing total body fat percentage measured by the portable Omron HBF-702T and the reference InBody 770 in male (n = 263) and female (n = 80) patients. Strong correlations were observed in both groups, although they were slightly lower in females

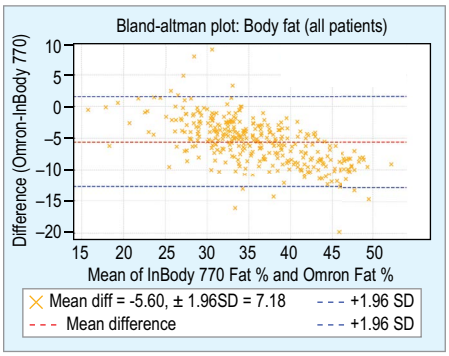
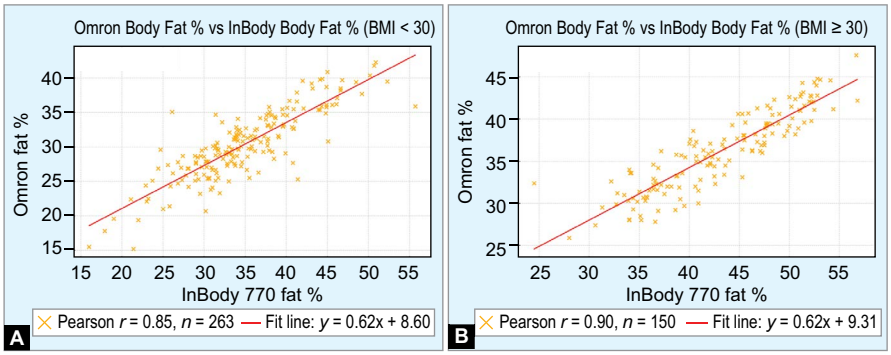


Fig. 2: Bland–Altman plot comparing total body fat percentage measured by the portable Omron HBF-702T and the reference InBody 770 in 341 patients. The Omron slightly underestimated body fat at higher levels, but overall agreement was good



Figs 4A and B: Scatter plots comparing total body fat percentage measured by the portable Omron HBF-702T and the reference InBody 770 in patients with BMI <30 kg/m^2 (n = 193) and BMI ≥30 kg/m^2 (n = 150). Correlations were strong in both groups, with slightly better agreement in those with higher BMI

Metabolic comorbidities were common: 39.6% had diabetes, 38.2% had hypertension, and 63.6% had dyslipidemia. A smaller subset also underwent liver stiffness measurement (LSM), of whom 42.1% had significant or advanced fibrosis.

Body composition analysis showed a high fat burden, with median body fat percentage measured at 32.6% (Omron) and 37.8% (InBody). The median visceral fat percentage by Omron was 16.0%, while the median visceral fat area by InBody was 160.4 cm^2, highlighting substantial visceral adiposity in this cohort.

Total Body Fat Percentage

The scatter plot (Fig. 1) illustrates a comparison of body fat percentage between the Omron HBF-702T and the InBody 770, the latter serving as the reference standard, across all 343 participants. The orange crosses represent individual measurements, with body fat percentage from the Omron device plotted on the Y-axis and InBody 770 on the X-axis. The red line shows the fit line derived from linear regression (y = 0.65x + 8.02), with a Pearson correlation coefficient (r = 0.91), indicating an excellent correlation between the two devices. Overall, the Omron device demonstrates strong accuracy compared with the InBody 770, though minor deviations are observed at higher body fat levels.

The Bland-Altman plot (Fig. 2) further assesses agreement between the Omron HBF-702T and InBody 770 for body fat percentage. The mean difference (bias) is shown by the red dashed line, while the blue dashed lines represent the limits of agreement [± 1.96 standard deviations (SD)]. The plot reveals a slight bias, with Omron tending to slightly underestimate body fat compared with InBody. Most measurements fall within the limits of agreement, confirming good concordance between the two devices, although some outliers are present at higher fat percentages.

Subgroup Analyses for Total Body Fat Percentage

Subgroup analyses were performed by gender and BMI categories. In males (Fig. 3A; n = 263), the scatter plot shows an excellent correlation between body fat percentages obtained from the Omron HBF-702T and the InBody 770. The fit line and Pearson correlation coefficient (r = 0.87) confirm that Omron performs well in estimating body fat in men, with only a slight tendency to underestimate values at higher fat percentages.

Among females (Fig. 3B; n = 80), the scatter plot demonstrates a moderately strong correlation between Omron and InBody measurements. The Pearson correlation coefficient (r = 0.78) indicates that Omron provides a reasonably reliable estimate of body fat in women, although minor discrepancies appear at higher body fat levels.

In participants with BMI <30 (Fig. 4A; n = 193), the correlation between Omron and InBody was good (r = 0.85), though Omron tended to slightly underestimate body fat compared with the reference standard. In participants with BMI ≥30 (Fig. 4B; n = 150), the correlation was even stronger (r = 0.90), suggesting that Omron provides a highly reliable estimate of body fat in individuals with higher BMI, despite a modest underestimation at the upper end of fat values.

The forest plot (Fig. 5) summarizes Pearson correlation coefficients across all subgroups. High overall correlation was observed in the full cohort (r = 0.91) and in participants with BMI ≥30 (r = 0.90). Slightly lower, though still substantial, correlations were seen in

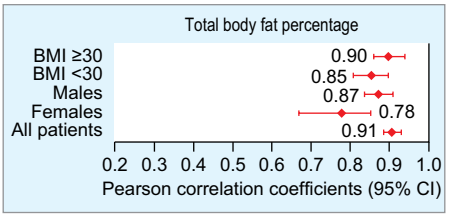
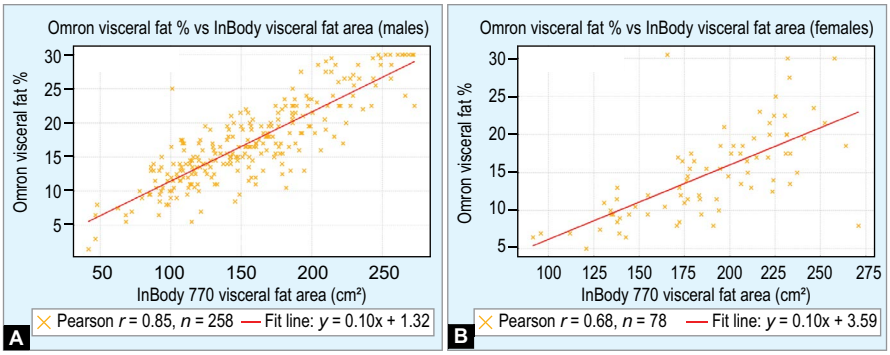


Fig. 5: Forest plot showing Pearson correlation coefficients for total body fat percentage measured by the portable Omron HBF-702T compared with the reference InBody 770 across different subgroups (overall, by gender, and by BMI categories). The strongest correlations were observed in the overall cohort and in patients with higher BMI



Figs 8A and B: Scatter plots comparing visceral fat estimates from the portable Omron HBF-702T and the reference InBody 770 in male (n = 258) and female (n = 78) patients. Correlation was strong in males but more modest in females, suggesting gender-related variability in measurement accuracy

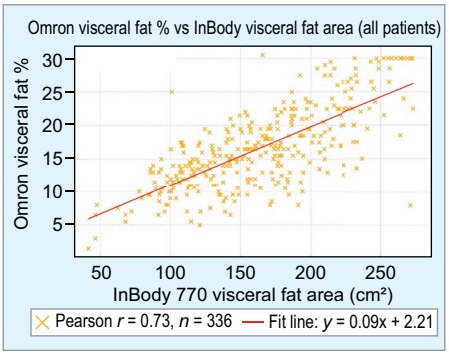
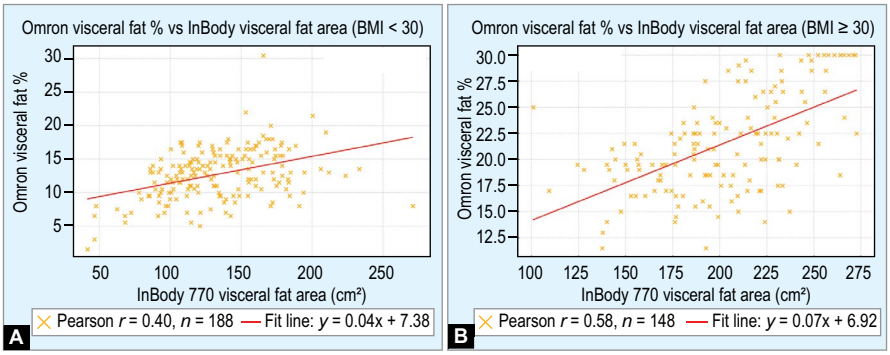


Fig. 6: Scatter plot comparing visceral fat percentage measured by the portable Omron HBF-702T with visceral fat area measured by the reference InBody 770 in 336 patients. A good overall correlation was observed, although variability increased at higher fat levels



Figs 9A and B: Scatter plots comparing visceral fat estimates from the portable Omron HBF-702T and the reference InBody 770 in patients with BMI <30 kg/m² (n = 188) and BMI ≥30 kg/m² (n = 148). Correlation was weaker in patients with lower BMI and moderate in those with higher BMI

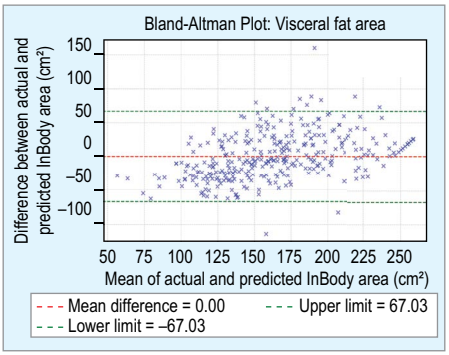


Fig. 7: Bland–Altman plot comparing visceral fat estimates from the portable Omron HBF-702T and the reference InBody 770 in 336 patients (values normalized for unit differences). The plot shows no significant systematic bias, although variability increased across the range

females (r = 0.78) and in those with BMI <30 (r = 0.85). These findings suggest strong overall performance of Omron, with minor variability depending on demographic and physiological factors.

Visceral Body Fat Estimation

The scatter plot (Fig. 6) shows the relationship between visceral fat percentage measured by the Omron HBF-702T and visceral fat area determined by the InBody 770, the latter serving as the reference standard, across 336 participants. Each orange cross represents an individual measurement, with Omron values plotted on the Y-axis and InBody values on the X-axis. The regression line (y = 0.09x + 2.21) demonstrates a good correlation (r = 0.73) between the two methods. While the Omron device is generally accurate, some variability is seen, particularly at higher levels of visceral fat, compared with the InBody 770.

The Bland-Altman plot (Fig. 7) further examines agreement between the two devices. Because Omron provides visceral fat as a percentage and InBody reports area in cm², normalization was performed before comparison. After adjustment, the mean difference between the two methods was close to 0, suggesting no significant systematic bias. However, the wide limits of agreement (–67.03 to +67.03 cm²) highlight variability that could affect clinical interpretation. Approximately 95% of measurements fell within these limits, indicating reasonable but imperfect concordance. This analysis underscores that while Omron provides practical estimates of visceral fat, its prediction accuracy has inherent variability when compared with the reference standard.

Subgroup Analyses for Visceral Fat Estimation

The scatter plot (Figs 8A and B) shows a strong correlation (r = 0.85) between Omron visceral fat percentage and InBody visceral fat area among male participants (n = 258), with a regression slope of 0.10 and intercept of 1.32. This suggests that in men, Omron's estimates align closely with InBody's, though with a slight systematic increase at higher visceral fat levels. In contrast, in females (n = 78), the correlation was more modest (r = 0.68), with a regression slope of 0.10 and intercept of 3.59. The higher intercept in women indicates that Omron may report a relatively higher baseline visceral fat compared with InBody, suggesting possible gender-related calibration differences.

BMI stratification revealed further variability (Figs 9A and B). In participants with BMI <30 (n = 188), correlation was weaker (r = 0.40), and the regression line (slope = 0.04, intercept = 7.38) indicated lower sensitivity of Omron at the lower end of visceral fat levels. By contrast, in those with BMI ≥30 (n = 148), correlation improved (r = 0.58), with a regression slope of 0.07 and intercept of 6.92, suggesting Omron is more reliable in individuals with higher BMI, though some underestimation remains.

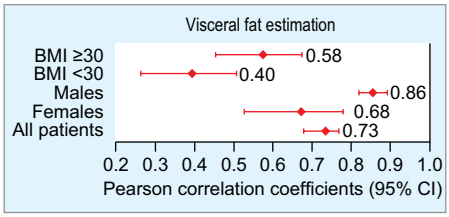


Fig. 10: Forest plot showing Pearson correlation coefficients for visceral fat estimates from the portable Omron HBF-702T compared with the reference InBody 770 across different subgroups (overall, by gender, and by BMI categories). The strongest correlations were observed in males and in the overall cohort, whereas weaker correlations were noted in females and patients with lower BMI

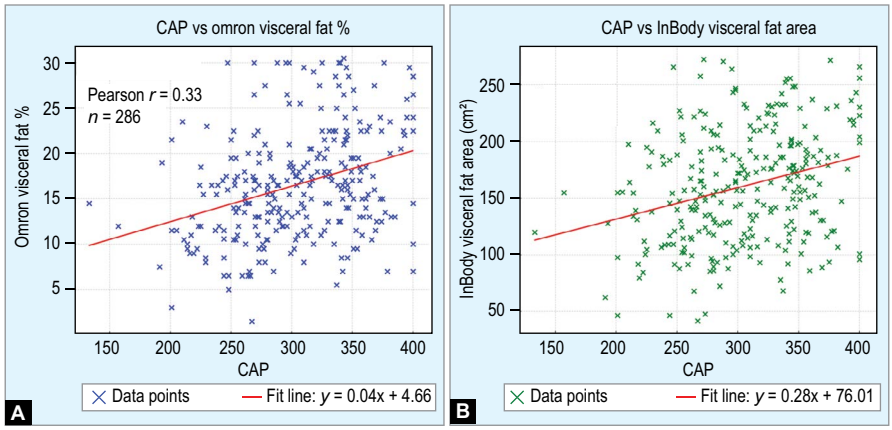


Fig. 11: Scatter plots showing the relationship between controlled attenuation parameter (CAP) values and visceral fat estimates from the portable Omron HBF-702T (left) and the reference InBody 770 (right). Both devices showed only weak correlations with CAP, indicating limited predictive value for liver fat content

The forest plot (Fig. 10) summarizes Pearson correlation coefficients across subgroups. The strongest correlation was seen in men ($r = 0.86$) and in the overall population ($r = 0.73$). Correlations were notably weaker in women ($r = 0.68$) and in participants with BMI <30 ($r = 0.40$), underscoring that visceral fat estimates by Omron may be less reliable in these groups. These subgroup findings highlight the need for cautious interpretation in clinical practice, particularly for females and leaner individuals.

Correlation of Visceral Fat Estimation with Controlled Attenuation Parameter by Transient Elastography

The scatter plots (Fig. 11) examined the relationship between controlled attenuation parameter (CAP) values, a marker of liver fat on transient elastography, and two measures of visceral fat: Omron visceral fat percentage and InBody 770 visceral fat area. Both showed weak correlations, with Pearson coefficients of 0.33 for Omron and 0.28 for InBody. Considerable variability was observed, suggesting that visceral fat and hepatic steatosis are only partially related and are influenced by different metabolic factors.

These findings indicate that while higher visceral fat may be associated with higher CAP values, the relationship is modest. Liver fat and visceral fat therefore represent distinct, though overlapping, components of metabolic risk, emphasizing the importance of assessing both independently in clinical practice.

Discussion

Our study demonstrates that the portable Omron HBF-702T provides body fat measurements that closely align with those of the InBody 770, a widely used reference BIA device. For total body fat percentage, the correlation was excellent ($r = 0.91$), with only minor underestimation by Omron at higher fat levels. Visceral fat estimates also showed good overall correlation ($r = 0.73$), though variability was more evident, particularly at higher fat ranges. Subgroup analyses highlighted that Omron performed best in males ($r = 0.87$ for total fat; $r = 0.85$ for visceral fat) and in individuals with BMI ≥30 ($r = 0.90$ for total fat; $r = 0.58$ for visceral fat), whereas correlations were weaker in females and in participants with BMI <30. Bland-Altman plots supported these findings, showing overall good agreement with some outliers. A graphical summary of the study design, methodology, and key results is presented in Figure 12.

The rising prevalence of obesity and type 2 diabetes has created an urgent need for accurate tools to assess body composition, especially given the central role of visceral fat in driving cardiometabolic risk.[1–3,5] While BMI has traditionally been used to classify obesity, it does not capture fat distribution or metabolic health, and its limitations are increasingly recognized.[6,7] Clinical guidelines now emphasize abdominal adiposity markers such as waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR), which correlate more strongly with adverse metabolic outcomes8. Importantly, in obesity and diabetes management, the clinical focus is shifting from weight loss alone to targeted fat loss, particularly visceral fat reduction, as this has greater implications for improving insulin resistance, cardiovascular health, and outcomes in conditions such as MASLD.

BIA devices have become widely used for estimating body and visceral fat in a practical, noninvasive manner. The InBody 770 is recognized as a reference standard among BIA devices, but its large size and high cost limit routine use in primary care or smaller clinics. By contrast, portable and affordable devices such as the Omron HBF-702T could make body fat monitoring more accessible in day-to-day clinical practice and even at home. Our study therefore evaluated the accuracy of the Omron HBF-702T compared with the InBody 770 in Indian patients with obesity, diabetes, and MASLD, with subgroup analyses by gender and BMI.

BIA technology has become a popular and accessible method for estimating body fat due to its noninvasive nature, ease of use, and relatively low cost. BIA works by sending a low-level electrical current through the body and measuring the resistance (impedance) to the flow of the current. Because fat, muscle, and water content conduct electricity differently, BIA devices can estimate the amount of fat, muscle, and other tissues based on the resistance detected.[16,17] The Omron HBF-702T uses a safe, weak electrical current (50 kHz, single frequency, 500 µA), which measures impedance at one frequency to provide these measurements. The InBody 770 employs multifrequency BIA, allowing it to provide more detailed body composition analyses, including muscle mass, intracellular and extracellular water content, and visceral fat area. The use of multiple frequencies in the InBody machine enhances its precision, especially for visceral fat measurement. These differences in technology explain why the InBody device is considered a reference standard, while the Omron offers a more practical option for routine clinic or home monitoring.

Our results demonstrate that the Omron HBF-702T performed exceptionally well in estimating total body fat, both in the overall cohort and across subgroups. The strong correlation between Omron and InBody 770 for total body fat percentage ($r = 0.91$)

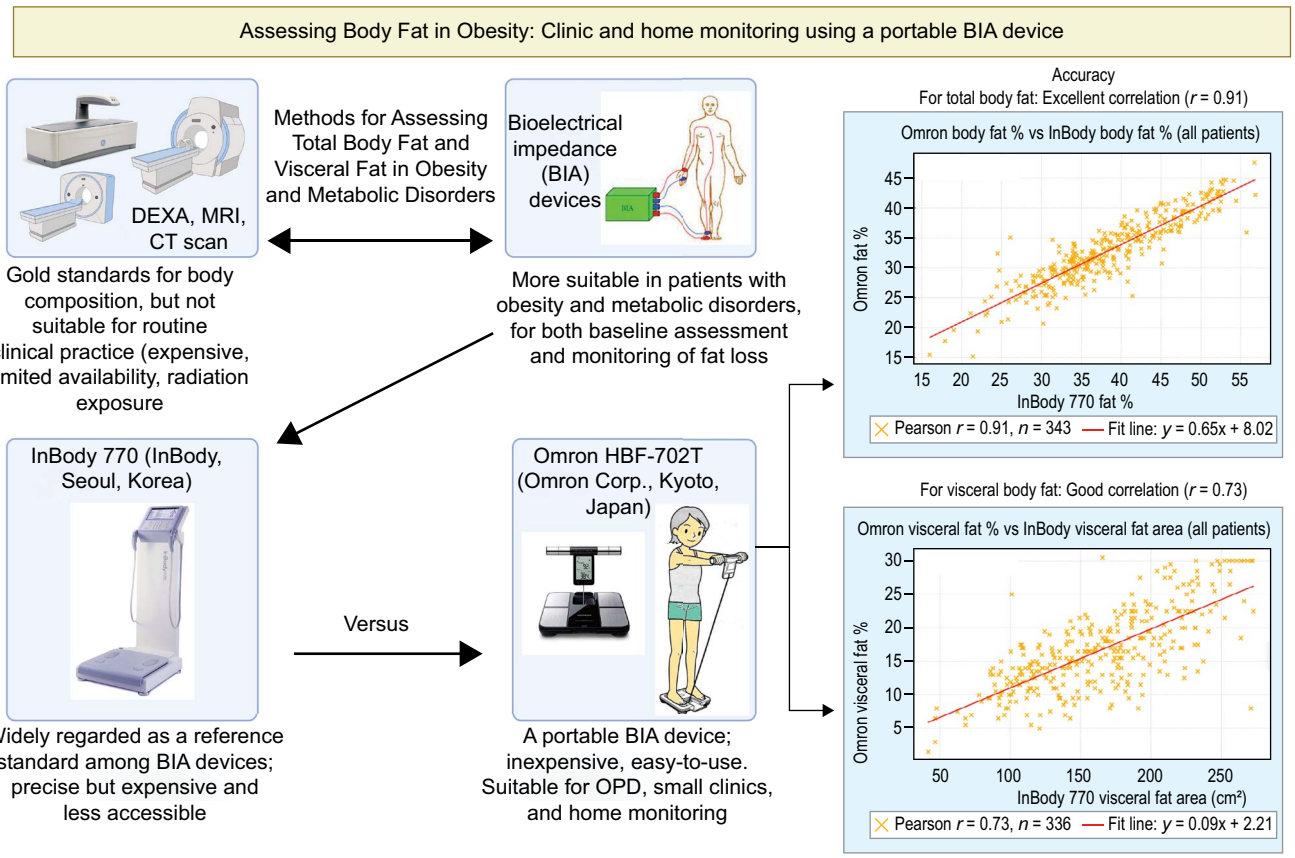


Fig. 12: Graphical summary of the study comparing the portable Omron HBF-702T with the InBody 770 for estimation of total body fat and visceral fat. The figure highlights gold-standard imaging methods, study devices, and key correlation results ($r = 0.91$ for total body fat; $r = 0.73$ for visceral fat)

indicates that Omron provides reliable estimates in clinical populations with obesity and diabetes. Subgroup analyses further confirmed this consistency: the correlation coefficient was 0.87 in men and 0.78 in women, both reflecting good agreement. Performance across BMI categories was also robust, with correlations of 0.85 in participants with BMI <30 and 0.90 in those with BMI ≥30. These findings suggest that Omron is a reliable tool for assessing total body fat across diverse demographic and physiological profiles, making it a practical option for both clinical and home use, especially in settings where access to larger devices such as the InBody 770 is limited.

Visceral fat is a particularly important parameter in obesity and diabetes because of its strong association with insulin resistance, systemic inflammation, and cardiovascular disease. It also contributes to the development and progression of MASLD.[5,18] Unlike subcutaneous fat, visceral fat surrounds internal organs and is metabolically more active, thereby exerting greater adverse effects on metabolic health. In our study, the Omron HBF-702T measured visceral fat as a percentage, whereas the InBody 770 provided visceral fat area in square centimeters, which is considered a more precise metric. We observed a good overall correlation between the two devices ($r = 0.73$), but Omron's performance showed variability across subgroups. In participants with BMI <30, the correlation was weaker, with a tendency toward underestimation. Similarly, in women, the correlation was moderate ($r = 0.68$), suggesting some gender-related variability in measurement accuracy. Despite these limitations, Omron offers important advantages: its portability, affordability, and ease of use make it feasible for repeated measurements in both clinic and home settings. This capacity for regular monitoring is valuable for long-term management of obesity, diabetes, and related conditions, particularly when treatment goals increasingly focus on reducing visceral fat rather than weight alone.

Our analysis of the correlation between visceral fat (measured by Omron and InBody) and liver fat content [assessed by controlled attenuation parameter (CAP)] revealed poor associations. The Pearson correlation coefficients were modest, with Omron showing $r = 0.33$ and InBody showing $r = 0.28$, indicating only weak relationships. This finding is not unexpected: although visceral fat is strongly linked to metabolic risk and contributes to conditions such as insulin resistance, cardiovascular disease, and MASLD, it does not directly quantify hepatic steatosis. Liver fat accumulation is influenced by multiple additional factors, including genetic predisposition, dietary patterns, and systemic metabolic status. Thus, visceral fat and liver fat represent related but distinct components of metabolic health.

While visceral fat assessment is valuable for monitoring obesity and diabetes, accurate liver fat quantification requires dedicated tools such as CAP or advanced imaging modalities like MRI proton density fat fraction (MRI-PDFF) or magnetic resonance spectroscopy.[19] In clinical practice, both visceral fat and liver fat should ideally be evaluated, as they provide complementary insights into metabolic and liver-related risks.

Although BIA is commonly used, it is not considered the gold standard for body fat estimation. The actual gold standard for fat estimation is DEXA, which provides highly accurate measurements of total body fat, lean mass, and bone density.[20] Other methods include hydrostatic weighing, air displacement plethysmography (BodPod), and MRI or CT scans, which can measure body composition with high precision but are more expensive and less accessible in clinical settings.[21] In contrast, BIA offers a more practical solution for routine monitoring, though it is slightly less precise compared with these gold-standard methods such as DEXA and MRI. Thus, while BIA is widely used for its convenience, it should be interpreted with caution, particularly in clinical contexts where precision is critical. In this context, our findings support the role of portable BIA devices such as Omron as a feasible compromise between accuracy and accessibility for routine use in obesity, diabetes, and related metabolic disorders.

One of the key strengths of our study is the large sample size of 343 participants, which enabled robust subgroup analyses by gender and BMI. Another strength is the direct comparison of the Omron HBF-702T with the InBody 770, a widely recognized reference standard among BIA devices. This provided a clear benchmark for evaluating the performance of a more portable and affordable alternative. Our findings have direct clinical relevance, offering practical insights into the use of Omron for assessing total and visceral fat in patients with obesity, diabetes, and related metabolic conditions. The accessibility and ease of use of this device make it particularly valuable in resource-limited settings and for routine monitoring, including at home, where tracking fat reduction has become increasingly important in the context of lifestyle interventions and newer pharmacological therapies such as glucagon-like peptide-1 (GLP-1) receptor agonists.

Our study has several limitations that should be considered when interpreting the results. First, we did not compare the Omron HBF-702T or the InBody 770 with the actual gold standard for body fat estimation, which is DEXA. Such a comparison would have provided more definitive validation of accuracy for both total and visceral fat estimation. Second, although our study demonstrated strong correlations between the two devices, it was cross-sectional in design, and we did not evaluate the ability of Omron to track longitudinal changes in fat over time. This limits conclusions about its utility for monitoring interventions such as lifestyle modification or GLP-1 therapy. Third, the study was conducted at a single tertiary care center with a relatively homogeneous patient population, which may affect generalizability to more diverse community and primary care settings. Finally, as with all BIA methods, measurements may be influenced by factors such as hydration status and recent food intake. Although we attempted to standardize these variables, some degree of variability is inevitable.

Conclusion

Our study demonstrates that the portable BIA device Omron HBF-702T is a reliable and practical tool for assessing total body fat, showing strong correlations with the reference InBody 770 across all subgroups, including gender and BMI categories. For visceral fat estimation, the device performed reasonably well in the overall cohort, though correlations were weaker in women and in individuals with BMI <30. Despite these limitations, the Omron HBF-702T remains a valuable option for routine monitoring, given its portability, affordability, and suitability for use in both clinical practice and home settings.

Future studies should include direct comparisons with DEXA, the gold standard for body composition analysis, to provide definitive validation. Longitudinal studies are also needed to evaluate its ability to track changes in body and visceral fat over time, particularly in the context of lifestyle modification and newer pharmacological therapies such as GLP-1 receptor agonists. These efforts will help establish the role of portable BIA devices in the day-to-day management of obesity, diabetes, and related metabolic disorders.

Use of Editing Tools

During the preparation of this work, the authors used ChatGPT (OpenAI, San Francisco, CA, USA) to improve the English language of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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