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Original Article

A comparative study of body composition of male patients with Type 2 Diabetes in age group of 30 to 50 years on basis of duration of disease

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ABSTRACT

Purpose: Type 2 Diabetes Mellitus (T2DM) is associated with altered body composition as the disease advances. This study aimed to compare body composition metrics in male T2DM patients aged 30–50 years, stratified by disease duration (≤3 years vs.>3 years), and to determine any associations with disease duration. Methods: This is a prospective observational study that included 100 male patients with T2DM (aged 30–50 years) attending the Medicine/Endocrinology outpatient departments at Medical College Hospital over a two-year period (2015–2016). They were divided equally into Group 1 (1–3 years duration) and Group 2 (>3 years). Body composition was measured by bioelectrical impedance (Omron HBF 306). Direct parameters (% body fat, % total body water, muscle mass, bone mass, visceral fat) and derived parameters (total fat mass, active body mass, % ABM) were computed. Results: The groups differed significantly in mean age (Group 1: 38.29 ± 5.80 years vs Group 2: 44.75 ± 5.01 years; $p < 0.0001$). However, height, weight, BMI, residence, smoking, alcoholism, exercise, and family history were not significantly different. Body composition parameters (body fat %, TBW, muscle mass, bone mass, visceral fat) did not show significant differences between groups. Correlation with duration showed that only age had an intermediate correlation ($r = 0.4843$, $p < 0.0001$). Conclusion: In this cohort, duration of T2DM in male patients aged 30–50 was not strongly associated with major alterations in body composition, except for an association with increasing age. Further studies with larger sizes, inclusion of waist circumference, and follow- up designs are recommended.

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Introduction

Background: Type 2 Diabetes Mellitus (T2DM) is a prevalent metabolic disorder characterized by chronic hyperglycaemia, often developing in adults, and marked by insulin resistance and failure of compensatory insulin secretion. It is also called adult-onset diabetes, non-insulin-dependent diabetes mellitus (NIDDM), or late-onset DM. Globally, about 382 million people live with diabetes (≈8.5% of population), and an estimated 175 million remain undiagnosed. (1) In India alone, over 62 million people (7.1% of adult population) are affected (2).

Rapid epidemiological changes in diet, sedentary lifestyle, and obesity drive this surge. In Asian populations, younger to middle-age adults carry a larger burden of T2DM than in Western countries.

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T2DM pathophysiology involves insulin resistance, defective insulin secretion, excessive hepatic glucose production, and deranged lipid metabolism. Central (visceral) fat deposition plays a stronger role in insulin resistance than peripheral adiposity. Elevated free fatty acids and adipocyte-derived factors worsen insulin resistance, while obesity suppresses adiponectin production, contributing to hepatic insulin resistance. (3-5)

While body mass index (BMI) has been widely used, central obesity measures (waist circumference, waist-hip ratio) and techniques like bioelectrical impedance analysis (BIA) provide more nuanced insight into fat and lean mass distribution. Earlier studies have produced mixed results on T2DM's impact on fat distribution, muscle infiltration, lean mass, and bone mass. Some report higher total body fat in T2DM; others do not.

Given these inconsistencies and the paucity of Indian male-focused data, this study aimed to compare body composition in T2DM male patients (aged 30–50) based on disease duration, and find out the associations between duration of disease and body composition parameters.

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Objectives: The aim of the current study is to compare the body composition in male patients with Type 2 Diabetes Mellitus aged 30 to 50 years, differentiating those with disease duration of three years or less versus those with more than three years. One of the objectives is to examine whether increasing duration of diabetes is associated with abnormalities in body composition.

METHODS

Study Design & Setting: Prospective observational study at the Medicine and Endocrinology Out Patient Departments of Medical College Hospital, from January 2015 to December 2016. Ethical approval was obtained, and written informed consent from participants.

Study Population: In our study, male Type 2 Diabetes Mellites patients (age 30–50 years) with diagnosis for at least one year and willing to consent were eligible; those with very recent onset, comorbid asthma, cardiovascular or metabolic disorders, physical deformities or inability to stand, oedema, fever, pacemakers, patients on dialysis, or professional athletes or bodybuilders were excluded.

Study size: Sample size was based on expected standard deviations (6.1 and 6.0) and powered at 80% with $\alpha = 0.05$ and pooled variance ($\sigma \approx 6.05$) which was then computed to detect a difference (δ) of approximately 3.4 units that would require about 50 subjects per group. A total of 100 participants (50 per arm).

Grouping: The participants were stratified into two groups by disease duration: Group 1 with duration of 1 to 3 years, and Group 2 with duration > 3 years (targeting ≈50 subjects per group).

Ethics statement: The study was conducted after the prior ethics review from the Institutional Ethical Committee with approval number No.

Data Collection & Procedure: Participants were examined in fasting state at 9 a.m. on Omron Body Fat Monitor (HBF 306). Participants removed metallic items and stood erect on the analyzer with handles. Anthropometric measures (weight, height) and direct body composition parameters were recorded i.e., Percent Body Fat, Percent Total Body Water (TBW), Muscle Mass (kg), Bone Mass (kg), Visceral Fat (kg).

Derived parameters were calculated as:

- Total Fat Mass = weight × % body fat / 100
- Active Body Mass (ABM) = weight – Total Fat Mass
- % ABM = (ABM / weight) × 100

Statistical Analysis: Descriptive statistics were used for baseline characteristics. Parametric data are presented as mean ± SD. Comparisons between groups used independent (unpaired) t- tests. Correlation (Spearman's) assessed relationships between disease duration and body composition variables. SPSS v21 was used for computation. $P < 0.05$ considered statistically significant.

Results

Participant Disposition & Demographics Of 100 recruited, 47 subjects had disease duration ≤ 3 years (Group 1) and 53 had >3 years (Group 2).

Age Distribution:

The mean age across participants was 41.72 ± 6.27 years. Group 1 had mean age 38.29 ± 5.80 years, significantly lower than Group 2 (44.75 ± 5.01 years; $p < 0.0001$). Age category distribution differed significantly: 31–35 years was predominant in Group 1 (46.81%) vs minimal in Group 2 (3.77%); 46–50 years was predominant in Group 2 (54.72%) vs 19.15% in Group 1 (χ^2 test, $p < 0.0001$).

Residence:

In the study, 31.91% patients were from rural region and 68.09% patients were from urban region in Group 1. Similarly 41.51% patients were from rural area and 58.49% patients were from urban region indicating that the population was slightly greater from urban region in Group 2.

Family History & Lifestyle Factors:

Hypertension and diabetes were common family histories; proportions did not differ significantly ($p = 0.806$). Smoking, alcoholism, exercise habits, and concomitant diseases showed no significant group differences ($p > 0.05$ across comparisons).

Anthropometrics:

Height (1.66 ± 0.09 m vs 1.65 ± 0.11 m), weight (75.70 ± 8.00 kg vs 75.49 ± 8.72 kg), and BMI (27.73 ± 3.90 vs 27.95 ± 5.12) were similar between groups (all $p > 0.05$).

Body Composition Parameters:

- Body Fat %: Group 1 = 25.93 ± 2.81; Group 2 = 26.06 ± 2.96 ($p = 0.8216$)
- Total Body Water: 47.53 ± 3.22% vs 47.39 ± 3.05% ($p = 0.8300$)
- Muscle Mass: 47.69 ± 3.43 kg vs 46.67 ± 3.22 kg ($p = 0.1285$)
- Bone Mass: 2.81 ± 0.18 kg vs 2.73 ± 0.23 kg ($p = 0.0732$)
- Visceral Fat: 14.50 ± 3.06 kg vs 15.01 ± 2.48 kg ($p = 0.3568$) None of these showed statistically significant differences.

Correlation with Duration:

Only age had a moderate positive correlation with duration ($r = 0.4843$, $p < 0.0001$). Other variables including BMI, body fat, muscle, bone mass, visceral fat, and lifestyle/demographic variables showed no correlation with duration.

Discussion

In this prospective observational study conducted at a tertiary hospital from 2015 to 2016, we enrolled 100 male Type 2 Diabetes Mellites patients (aged 30–50, disease duration ≥ 1 year) and excluded those with early diagnosis, significant comorbidities, or inability to undergo measurement. Patients were split into two groups: short duration (≤ 3 years; n = 47) and longer duration (> 3 years; n = 53).

Notably, the mean age of the cohort was 41.72 ± 6.27 years; however, Group 1 (38.29 ± 5.80 years) was significantly younger than Group 2 (44.75 ± 5.01 years, $p < 0.0001$). Age distribution also differed: nearly half of Group 1 were in the 31–35- year range, compared to a small fraction in Group 2 ($p < 0.0001$). These findings suggest that those with shorter disease duration tended to present earlier in life or were enrolled earlier in their disease course.

Comparative literature shows some alignment and some divergence: other Indian cohorts often report higher mean diagnostic ages [6-10]. As in our study, many participants in past work were male—consistent with findings that men may be diagnosed earlier and at lower BMI than women. In our cohort, urban residence predominated, though the difference between groups was not statistically significant. Family history of diabetes and hypertension was common but similarly distributed across groups; anthropometric measures (height, weight, BMI) did not differ meaningfully between groups and matched values reported in similar Indian populations.

Regarding body composition, we observed no statistically significant differences between groups in percentage body fat, total body water, muscle mass, bone mass, or visceral fat. Though these results may appear null, they are consistent with some studies indicating that disease duration alone may not necessarily alter these parameters markedly in the medium term. Recent work highlights visceral adipose tissue (VAT) as a central driver of metabolic derangement, more so than general adiposity (1), and disposition of visceral fat may mediate insulin resistance beyond gross measures. Some meta-analyses reinforce that visceral fat and fat distribution are stronger predictors of T2DM risk than BMI or total fat percent (11).

Correlation analysis further revealed that only age had a moderate positive association with disease duration ($r \approx 0.48$, $p < 0.0001$); no other body composition metrics or lifestyle or demographic variables showed meaningful correlation in our sample. This suggests that in a cross-sectional setup with limited duration spread, the changes in composition may be subtle or require longer follow-up to manifest.

Our study's strength lies in its focus on a male-only cohort and direct measurement of multiple body composition parameters within a narrowly defined age window. Nevertheless, limitations constrain interpretation: the cross-sectional design precludes causal inference, and absence of glycaemic control or waist circumference data limits understanding of central obesity's role. The sample size, while justified a priori, may also lack power to detect small-to-moderate differences. For deeper insights, longitudinal designs, inclusion of both sexes, imaging-based fat quantification (e.g. MRI or CT), and glycaemic indices will be invaluable.

In summary, among male T2DM patients aged 30–50, stratified by shorter vs longer disease duration, we did not detect major differences in body composition metrics other than age. These findings underscore that disease duration alone may not be a strong determinant of changes in fat/lean mass in the medium term. Future prospective and multimodal studies are warranted to clarify the temporal dynamics of body composition in T2DM and their clinical implications.

Conclusion

This observational study in male T2DM patients aged 30–50 found that disease duration (≤3 vs >3 years) was not significantly associated with changes in body composition (fat %, TBW, muscle mass, bone mass, visceral fat). Age was partially correlated with duration. Height, weight, BMI, family history, and lifestyle factors did not differ between groups. To better characterize progression-related body composition changes, future studies should incorporate waist measures, glycaemic indices, and longitudinal designs.

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