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Spirometric Indices in Adults with Type 2 Diabetes Mellitus: A Hospital-Based Comparative Cross-Sectional Study

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Abstract

***Background:** Type 2 diabetes mellitus (T2DM) may be associated with subclinical pulmonary dysfunction, but reported magnitudes vary widely, in part because studies differ in the reference equations and abnormality thresholds applied.*

***Material and Methods:** This hospital-based comparative cross-sectional study included 100 adults with T2DM and 100 age- and sex-matched controls at a tertiary care centre from March 2024 to May 2026. Participants were non-smokers aged 30 - 65 years without known cardiac or respiratory disease. Spirometry followed Indian Chest Society-National College of Chest Physicians (ICS-NCCP) and ATS/ERS standards. All indices – FVC, FEV1, FEV1/FVC, PEF and FEF25-75 – were referenced to a single published north Indian equation set, and abnormality was defined exclusively by the statistically derived lower limit of normal (LLN = predicted - 1.645* SEE). Fixed cut-offs were entirely omitted from definitions. Because total lung capacity was not measured, a low FVC with a preserved ratio was described as a low-volume spirometric pattern, not confirmed restriction. Comparisons used Welch's t-test, the chi-square test with an unconditional odds ratio, and Pearson correlations.*

***Results:** Adults with T2DM had lower FVC (2.52 ± 0.68 L versus 3.06 ± 0.72 L; mean difference -0.54 L; 95% CI -0.74 to -0.35) and FEV1 (2.11 ± 0.58 L versus 2.50 ± 0.61 L; -0.39 L; 95% CI -0.56 to -0.23). Expressed as per cent predicted, deficits were -17.1 percentage points for FVC (95% CI -20.2 to -13.9) and -16.8 for FEV1 (95% CI -21.1 to -12.6); p <0.001 for each. The FEV1/FVC ratio was marginally higher in the T2DM group (+1.6 percentage points; 95% CI +0.2 to +3.0; p = 0.023). Using the statistical LLN criteria, a low-volume pattern occurred in 56% of the T2DM group and 5% of controls (OR 24.18; 95% CI 9.06 to 64.57). No participant in either group exhibited an FEV1/FVC ratio below its LLN. Within the T2DM cohort, FVC and FEV1 correlated inversely with HbA1c and diabetes duration.*

***Conclusions:** Non-smoking adults with T2DM showed lower spirometric volumes with a preserved FEV1/FVC ratio and a frequent low-volume pattern. These cross-sectional findings are compatible with pulmonary involvement in T2DM but do not establish true restrictive ventilatory defects, which require lung-volume measurement.*

***Key words:** Type 2 diabetes mellitus, spirometry, forced vital capacity, lower limit of normal, reference equations.*

Introduction

Diabetes mellitus remains an expanding global health challenge. The International Diabetes Federation estimates that 589 million adults aged 20 - 79 years were living with diabetes in 2024, projected to reach 853 million by 2050[1]. Renal, retinal, neural and cardiovascular complications are thoroughly characterised; pulmonary involvement has received less attention[2,3].

The lung is plausibly susceptible to chronic hyperglycaemia. Non-enzymatic glycation can alter structural collagen and elastin, and microangiopathy can thicken the alveolar-capillary basement membrane[2-5]. These changes could reduce lung compliance, compromise elastic recoil, lower respiratory-muscle performance or impair gas transfer. Spirometry alone; however, cannot distinguish true restriction from submaximal inspiration, gas trapping, respiratory-muscle weakness or technical limitation; confirmation requires measurement of total lung capacity (TLC)[6].

Meta-analyses report modest reductions in FVC, FEV1 and expiratory flows in diabetes, typically with a preserved FEV1/FVC ratio[7-9]. Hospital-based series report larger deficits, with inconsistent associations with glycated haemoglobin (HbA1c) and diabetes duration[10-16]. Two major methodological choices plausibly contribute to this heterogeneity and are rarely made explicit. First, spirometers marketed in India commonly default to Caucasian reference equations; a study of 14,733 consecutive Indian spirometry records showed that Caucasian equations, and the widely used practice of 'ethnic discounting' by 10%, produce poor agreement with Indian equations and misclassify a substantial proportion of records[17]. Second, fixed thresholds (such as FVC <80%

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predicted or FEV1/FVC <0.70) remain in common use despite a Grade 1A recommendation favouring statistically derived lower limit of normal (LLN) criteria[6]. Fixed numbers misalign with true statistical boundaries across different indices, generating compounding diagnostic distortion.

This study compared spirometric indices between adults with T2DM and frequency-matched controls, deriving every index from a single north Indian reference equation set and characterising clinical abnormality exclusively through statistically derived population-specific LLN thresholds, while examining unadjusted associations with HbA1c and diabetes duration.

Material and Methods

Study Design, Setting and Ethics

This hospital-based comparative cross-sectional study was conducted in the Department of General Medicine at a tertiary care centre from March 2024 to May 2026. The protocol was approved by the Institutional Ethics Committee (Approval number: FHMC/IEC/R.Cell/2024/32). All participants gave written informed consent.

Participants

Adults aged 30 - 65 years with T2DM were recruited by consecutive sampling; T2DM was diagnosed per American Diabetes Association criteria[18]. Controls without diabetes were recruited from the outpatient health check-up clinic and from patient attendants, and were frequency-matched to the T2DM cohort by age and sex. Absence of diabetes was verified by fasting plasma glucose <100 mg/dL and HbA1c <5.7%.

Exclusion criteria for all participants: current or past smoking; known asthma, chronic obstructive pulmonary disease, interstitial lung disease, or previous/active tuberculosis; ischaemic heart disease, valvular heart disease or heart failure; chest-wall or spinal deformity; neuromuscular disease; body mass index (BMI) >30 kg/m^2; occupational exposure to hazardous dust or fumes; pregnancy; acute respiratory tract infection within four weeks; or any contraindication to spirometry[6].

A target of 100 participants per group was set *a priori* for the primary outcome (FVC per cent predicted), to detect a minimum clinically important difference of 5 percentage points assuming SD 11%, two-sided alpha 0.05 and 80% power (requiring 76 per group), with allowance for 10% unusable or unrepeatable tests.

Participant Flow

Of 145 individuals with T2DM screened, 45 were excluded (BMI >30 kg/m^2, n = 23; former or current smoking, n = 12; asthma or tuberculosis, n = 10), leaving 100 enrolled. Of 130 potential controls, 30 were excluded (unrecognised dysglycaemia, n = 18; smoking history, n = 8; active respiratory symptoms, n = 4), leaving 100. All 200 participants completed testing with no missing data for primary or secondary outcomes.

Clinical and Laboratory Assessment

All participants underwent history and standardised examination. Height was measured to the nearest 1 mm on a calibrated stadiometer with the head in the Frankfort plane, as recommended[6]; weight was measured on a calibrated electronic scale; BMI was calculated as weight (kg) divided by height (m) squared. Fasting plasma glucose was measured by the glucose oxidase-peroxidase method and HbA1c by high-performance liquid chromatography. Diabetes duration was taken from the verified date of clinical diagnosis.

Spirometry

Spirometry was performed with an EasyOne Pro spirometer (ndd Medical Technologies, Zurich, Switzerland) running EasyOne Connect software, by a trained technician, with the participant seated, per ICS-NCCP and ATS/ERS standards[6,19]. Volume validation with a 3-L syringe was performed daily (acceptance ± 3.5%), with weekly linearity checks; a log of all validation data was maintained.

Pre-test restrictions: short-acting bronchodilators withheld 6 h, long-acting bronchodilators 24 h, caffeine-containing products 6 h, alcohol 4 h, large meals 2 h and vigorous exercise 30 min before testing[6]. Testing was pre-bronchodilator. At least three acceptable and two repeatable manoeuvres were obtained (largest two FVC and largest two FEV1 within 150 mL), to a maximum of eight attempts. The largest acceptable FVC and largest acceptable FEV1 were recorded, whether or not from the same manoeuvre[6]. All curves were visually inspected before numerical acceptance.

Reference Values and Definition of Abnormality

Manufacturer-supplied predicted values were not used. Instead, all raw values were exported and predicted values for every index - FVC, FEV1, FEV1/FVC, PEF and FEF25-75 – were computed offline from the equations of Chhabra *et al* for adults of north Indian origin, which were derived under the 2005 ATS/ERS standardisation protocol[20]. This preserves the requirement that all reported parameters derive from a single reference source[6]. For indices modelled on the natural-log scale, predicted values were obtained as exp(Ln-predicted + 1/2 SEE2) per the source appendix. The female

PEF equation is printed in the source table without an 'Ln' prefix; its coefficients and SEE are only interpretable on the log scale (the linear reading returns physiologically impossible values of ~1.6 L/s), and it was therefore treated as log-transformed, consistent with the corresponding male equation.

Abnormality was defined exclusively as an observed value below its lower limit of normal (LLN), calculated strictly as predicted - 1.645* SEE, using the SEE published for each specific equation[6,20]. Universal fixed per cent-predicted cut-offs were completely excluded to clear the methodology of mathematical categorisation bias. For log-transformed indices, LLN was computed in log space and back-transformed. In this cohort the LLN corresponded, on average, to 78.7% of predicted for FVC, 75.2% for FEV1, 73.9% for PEF and 59.9% for FEF25-75; the LLN for FEV1/FVC averaged 65.6% in absolute terms.

Spirometric configurations were categorised into physiological patterns based purely on these statistical LLN thresholds: low-volume pattern, FVC < LLN with FEV1/FVC > = LLN; low-ratio pattern, FEV1/FVC < LLN with FVC > = LLN; and combined pattern, both parameters falling below their respective LLN thresholds. Consistent with guideline wording, a low-volume pattern is reported as suggestive of a restrictive ventilatory defect and is not diagnostic of one[6]. FEV1, FVC and FEV1/FVC were pre-specified as the interpretive variables. PEF and FEF25-75 were pre-specified as exploratory and are reported for descriptive completeness only, since guidelines do not recommend FEF25-75 for clinical interpretation[6,21].

Statistical Analysis

Continuous variables were expressed as mean ± SD, categorical variables as counts and percentages. Standardised mean differences (SMD) assessed baseline balance. Because participants were frequency-matched rather than individually linked, independent (unconditional) methods were used throughout. Between-group mean differences were estimated by Welch's independent-samples t-test. Effect sizes are reported as Cohen's d from pooled SD. Pattern distributions determined by the LLN criteria were compared between groups using the chi-square test, and the risk of presenting a low-volume pattern was summarised as an unconditional odds ratio (OR) with a 95% CI. Pearson correlation coefficients (r) with Fisher z-transformed 95% CIs quantified within-group associations. Scatter plots display unadjusted least-squares trend lines for illustration; no regression models were fitted for inference. All tests were two-sided at alpha = 0.05. Analyses used SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Reporting follows STROBE[22].

Results

Baseline Characteristics

The frequency-matched cohorts were balanced for age, sex, height and BMI (Table I). Mean age was 52.4 ± 8.6 years (T2DM) and 51.8 ± 8.9 years (controls); males comprised 58% of each group. Mean diabetes duration was 7.8 ± 4.5 years and mean HbA1c 8.4 ± 1.6%. Fasting glucose and HbA1c separated the groups as expected.

Table I: Baseline characteristics of adults with type 2 diabetes mellitus and age- and sex-matched controls.

Characteristic	T2DM (n = 100)	Controls (n = 100)	SMD
Age (years)	52.4 ± 8.6	51.8 ± 8.9	0.07
Male sex, n (%)	58 (58)	58 (58)	0.00
Height (cm)	162.7 ± 8.7	163.0 ± 8.3	0.04
Weight (kg)	65.6 ± 9.8	64.1 ± 9.2	0.16
BMI (kg/m2)	24.6 ± 2.7	24.2 ± 2.5	0.15
Fasting plasma glucose (mg/dL)	168.4 ± 42.6	88.7 ± 9.4	2.58
HbA1c (%)	8.4 ± 1.6	5.2 ± 0.4	2.74
Diabetes duration (years)	7.8 ± 4.5	–	–

Values are mean ± SD unless indicated. –, not applicable, An SMD below 0.10 indicates negligible imbalance.
BMI: body mass index; HbA1c: glycated haemoglobin; SMD: standardised mean difference.

Spirometric Indices

Absolute volumes and flows were lower in the T2DM group (Table II). FVC was reduced by 0.54 L (95% CI -0.74 to -0.35; d = -0.77) and FEV1 by 0.39 L (95% CI -0.56 to -0.23; d = -0.66). The observed FEV1/FVC ratio was marginally higher in the T2DM group (+1.63 percentage points; 95% CI +0.22 to +3.04; p = 0.023; d = +0.32).

Table II: Between-group differences in spirometric indices – absolute values.

Index	T2DM	Controls	Mean difference	95% CI	Cohen's d	p
FVC (L)	2.52 ± 0.68	3.06 ± 0.72	-0.54	-0.74 to -0.35	-0.77	**<0.001**
FEV1 (L)	2.11 ± 0.58	2.50 ± 0.61	-0.39	-0.56 to -0.23	-0.66	**<0.001**
FEV1/FVC (%)	83.8 ± 5.0	82.2 ± 5.1	+1.63	+0.22 to +3.04	+0.32	**0.023**
PEF (L/s)*	4.90 ± 1.52	6.40 ± 1.72	-1.50	-1.96 to -1.04	-0.92	**<0.001**
FEF25-75 (L/s)*	1.66 ± 0.42	1.92 ± 0.51	-0.26	-0.40 to -0.12	-0.56	**<0.001**

*Values are mean ± SD; n = 100 per group. Mean differences and 95% CIs from Welch's independent-samples t-test; Cohen's d calculated from the pooled SD. *Exploratory indices, not recommended for interpretation[6,21].*

Control-group means clustered near 100% of predicted for every volume and flow index (94.3-103.7%; Table III,

Fig. 1), showing the expected behaviour of a healthy reference group when a population-appropriate equation set is applied, and serving as an internal check that the reference source was correctly matched.

Table III: Between-group differences in volume and flow indices, expressed as per cent predicted (Chhabra *et al*)[20].

Index	T2DM	Controls	Mean difference	95% CI	Cohen's d	p
FVC (% predicted)	77.2 ± 12.4	94.3 ± 9.7	-17.06	-20.17 to -13.95	-1.53	**<0.001**
FEV1 (% predicted)	86.9 ± 17.2	103.7 ± 13.2	-16.84	-21.11 to -12.57	-1.10	**<0.001**
PEF (% predicted)*	78.4 ± 16.1	102.1 ± 13.6	-23.70	-27.85 to -19.56	-1.59	**<0.001**
FEF25-75 (% predicted)*	83.9 ± 11.8	96.4 ± 9.1	-12.51	-15.45 to -9.58	-1.19	**<0.001**

*Values are mean ± SD; n = 100 per group. *Exploratory indices. FEV1/FVC is not expressed as percent predicted: per ATS/ERS and ICS-NCCP the ratio is interpreted in absolute terms against its own LLN, and is reported in Table II[6,19].*

Spirometric Patterns

When applying the statistically derived LLN criteria, a low-volume pattern (FVC < LLN with a preserved FEV1/FVC >= LLN) occurred in 56 participants with T2DM (56%) versus 5 controls (5%). This configuration yielded an unadjusted odds ratio of 24.18 (95% CI 9.06 to 64.57; p <0.001) (Table IV). Notably, no participant in either the T2DM or control cohort exhibited an FEV1/FVC ratio below its corresponding LLN. Consequently, no low-ratio (obstructive) or combined spirometric patterns were found within the study population.

Table IV: Distribution of spirometric patterns by LLN criteria.

Pattern	T2DM (n = 100)	Controls (n = 100)
Normal	44 (44%)	95 (95%)
Low-volume (FVC <LLN with FEV1/FVC >= LLN)	56 (56%)	5 (5%)
Low-ratio (FEV1/FVC <LLN with FVC >= LLN)	0 (0%)	0 (0%)
Combined (both parameters <LLN)	0 (0%)	0 (0%)

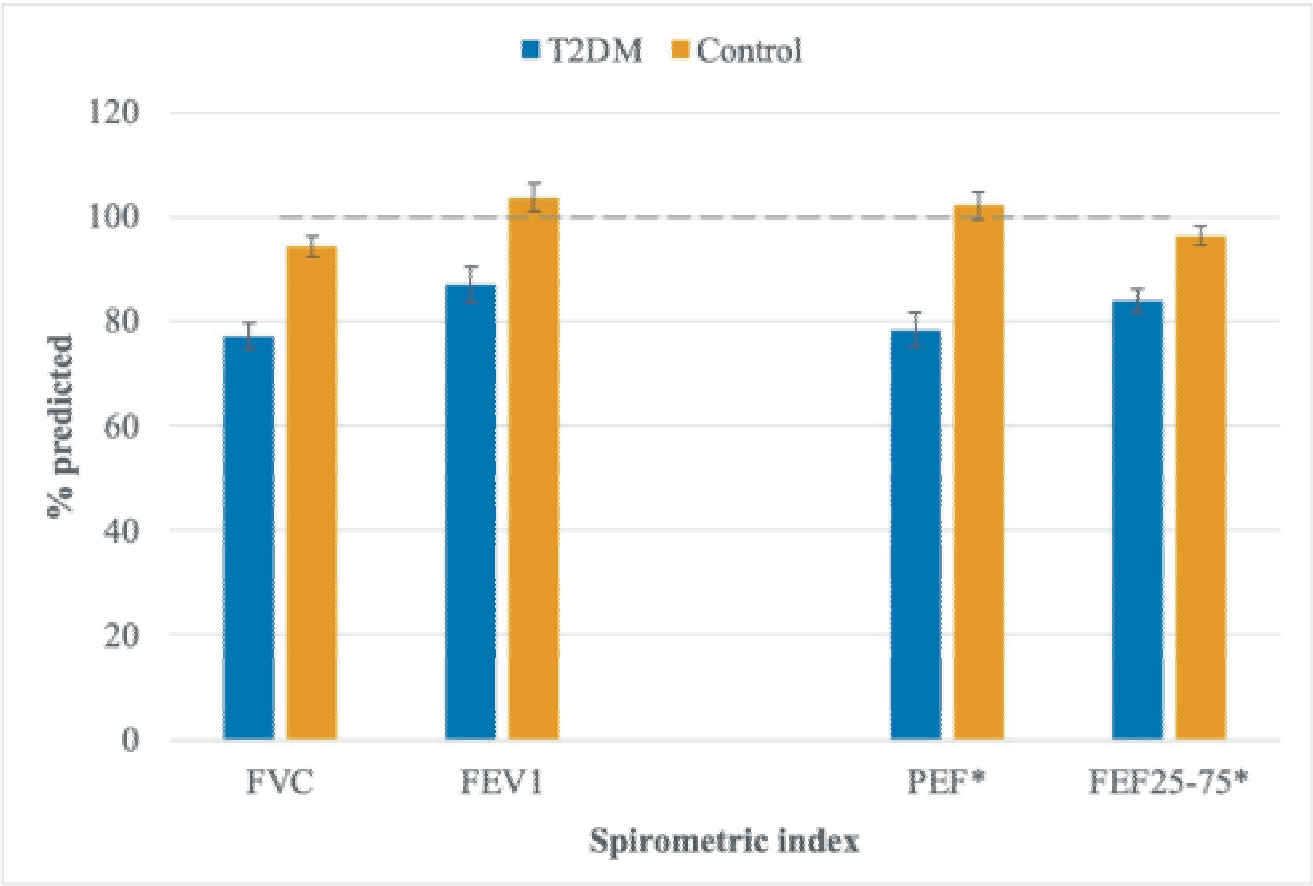


***Fig. 1:** Spirometric indices (per cent predicted) in adults with T2DM (n = 100) and age- and sex-matched controls (n = 100). Bars, group means; error bars, 95% CI. Dashed line marks 100% of predicted. All differences significant (p <0.001). *PEF and FEF25-75 are exploratory indices, shown separately and not recommended for clinical interpretation. FEV1/FVC is not shown, as the ratio is interpreted against its own LLN rather than as per cent predicted.*

*Values are n (%). LLN thresholds: FVC <predicted - 1.645 * SEE; ratio <predicted ratio - 1.645 * SEE. These categories describe spirometric configurations and do not confirm clinical restrictive or mixed ventilatory defects.*

Correlations with Metabolic Factors

Within the T2DM group, volumetric indices correlated inversely with glycaemic control and disease duration (Table V). FVC correlated inversely with HbA1c (r = -0.34; 95% CI -0.50 to -0.15; Fig. 2A) and with diabetes duration (r = -0.35; 95% CI -0.51 to -0.16; Fig. 2B); p < 0.001 for each. HbA1c and diabetes duration each accounted for approximately 12% of the variance in FVC per cent predicted (R^2 = 0.12 for both), indicating that most of the variation in lung volume in this cohort was not explained by either metabolic variable. FEV1 showed similar inverse correlations. The FEV1/FVC ratio showed no meaningful correlation with either parameter.

Table V: Correlations of spirometric indices with HbA1c and diabetes duration (T2DM group, n = 100).

Index	r vs HbA1c	95% CI	p	r vs duration	95% CI	p
FVC	-0.34	-0.50 to -0.15	**<0.001**	-0.35	-0.51 to -0.16	**<0.001**
FEV1	-0.38	-0.54 to -0.20	**<0.001**	-0.31	-0.48 to -0.12	**0.002**
FEV1/FVC	+0.08	-0.12 to +0.27	0.429	+0.06	-0.14 to +0.25	0.553
PEF*	-0.34	-0.50 to -0.15	**<0.001**	-0.28	-0.45 to -0.09	**0.005**
FEF25-75*	-0.30	-0.47 to -0.11	**0.002**	-0.24	-0.42 to -0.05	**0.016**

*Pearson r on per cent predicted. *Exploratory indices. HbA1c and duration were themselves correlated (r = 0.29), so these coefficients are not independent of one another. No adjustment was made for multiple comparisons; these are descriptive associations.*

Discussion

In this cohort, non-smoking adults with T2DM had lower FVC and FEV1 than age- and sex-matched controls, with a preserved – indeed marginally higher – FEV1/FVC ratio. Using the statistical LLN, a low-volume spirometric pattern was present in 56% of the T2DM group versus 5% of controls (OR 24.18), and no participant met LLN criteria for obstruction. Within the T2DM group, FVC and FEV1 correlated inversely with HbA1c and diabetes duration.

A defining feature of this study was that abnormality was judged only against population-specific LLN thresholds rather than fixed cut-offs[6]. Fixed limits such as FVC < 80% predicted or FEV1/FVC < 0.70 do not track the true lower boundary of the healthy range, which shifts with age, sex, height and the index itself, and so misclassify a variable proportion of records[17]. In this cohort the LLN averaged about 79% of predicted for FVC and 66% in absolute terms for the ratio, confirming that no single fixed number can represent the healthy boundary of every index at once. Anchoring the analysis to the LLN therefore makes the higher odds of a low-volume pattern in T2DM a departure from the population's own reference range rather than an artefact of an arbitrary threshold.

The direction of our findings matches the wider literature. Meta-analyses that together cover more than 140 studies report reduced FVC and FEV1 with a preserved FEV1/FVC ratio in diabetes[7-9], and cross-sectional case-control studies from Indian and other populations describe the same reduced-volume, ratio-preserved (restrictive-like) pattern[10,11,23,24]. Our low-volume pattern is therefore consistent with the dominant reading of the field, while

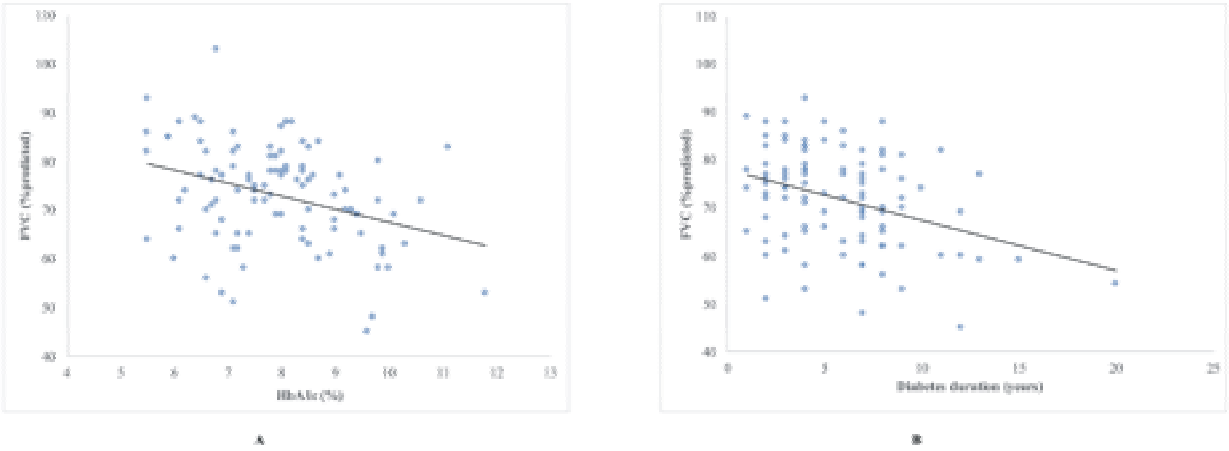


Fig. 2: *FVC (per cent predicted) plotted against HbA1c (panel A) and diabetes duration (panel B) in the T2DM group (n = 100). Each point represents one participant. Solid lines are ordinary least-squares fits shown for visual reference; inference is based on the Pearson correlation coefficients reported in Table V. Panel A, r = -0.34 (95% CI -0.50 to -0.15), R^2 = 0.12, p <0.001. Panel B, r = -0.35 (95% CI -0.51 to -0.16), R^2 = 0.12, p <0.001.*

the label 'restrictive' remains provisional without lung-volume measurement[6].

The magnitude of the deficit, and the frequency of the low-volume pattern, are at the higher end of what has been reported. Pooled meta-analytic FVC deficits are about -6.3 percentage points[7] and -9.21 percentage points[9], whereas we observed -17.1. A comparable Indian case-control study using a fixed 80%-predicted cut-off found a restrictive pattern in 54% of diabetic patients versus 10% of controls, giving roughly four-fold higher odds (OR 4.4)[23]; our low-volume pattern was similar in the diabetic group (56%) but rarer in controls (5%), giving a higher OR of 24.18. The similar case prevalence but lower control prevalence is consistent with a well-matched, non-smoking, non-obese control group referenced to a population-appropriate equation set, which keeps control means near 100% of predicted and prevents a reference mismatch from depressing both arms. Where Caucasian equations are applied to Indian participants, per cent-predicted values fall in both groups and the apparent prevalence of abnormality is inflated. We therefore report absolute values alongside per cent predicted so that others can re-reference our data.

Whether these deficits track glycaemic control and disease duration is the most divided question in this literature, and our data sit in the middle of it. We found modest inverse correlations of FVC and FEV1 with HbA1c and duration (Fig. 2). One group of studies reports significant negative correlations with poorer control or longer duration: the prospective Fremantle Diabetes Study and the ARIC cohort[14,15], and hospital studies in which FVC and FEV1 fell with rising HbA1c, sometimes strongly (for example, FEV1 versus HbA1c r = -0.74)[25], with lower FVC, FEV1 and PEF in poorly controlled patients[26], reduced volumes alongside raised inflammatory markers[12], and correlations with both HbA1c and duration[27]. Another group found no significant association with either variable[10,28]. Two large longitudinal cohorts add an important qualification: lung function in diabetes is lower but does not decline faster over time, and the deficit is already present before diabetes is diagnosed[16,29], which argues against a simple duration-dependent, glycation-driven process and raises the possibility of a shared antecedent such as insulin resistance. Because HbA1c and duration were themselves correlated in our data (r = 0.29) and our analyses are unadjusted, our coefficients should be read as descriptive associations, not as evidence of an independent dose-response.

No participant showed obstruction or a mixed pattern. This agrees with case-control studies reporting no obstructive component in non-smoking diabetic samples[23]. Where a mixed or obstructive picture has been described[27], it is most plausibly explained by the inclusion of smokers or by the use of fixed rather than LLN thresholds, both of which raise the apparent rate of obstruction.

Several mechanisms are proposed for lower lung volumes in diabetes: non-enzymatic glycation cross-linking collagen and elastin and degrading parenchymal elasticity, microangiopathic thickening of the alveolar-capillary basement membrane, low-grade systemic inflammation, respiratory-muscle weakness and autonomic neuropathy affecting chest-wall mechanics[2-5,30]. Because TLC and diffusing capacity (DLCO) were not measured, we cannot weight these pathways, and the low-volume pattern is also compatible with submaximal effort, which spirometry alone cannot exclude.

Spirometry may also understate pulmonary involvement in diabetes. Several studies that measured diffusing capacity found DLCO (or DLCO/VA) reduced, and falling with HbA1c, disease duration or microangiopathy, even when spirometric volumes were normal or near-normal[13,24,31,32]. Because we did not measure DLCO or TLC, our spirometry-based low-volume pattern probably captures only part of the picture, and normal spirometry in a diabetic patient should not be taken as reassurance. This is a further argument for adding DLCO, and ideally lung-volume measurement, to future assessment.

Interpretation of PEF and FEF25-75 requires particular restraint. ICS-NCCP guidelines carry a Grade 2A recommendation against reporting FEF25-75 and FEF75[6], and Quanjer *et al* showed they do not contribute to clinical decision making[21]. FEF25-75 is measured across a fraction of FVC, so any systematic reduction in FVC mechanically lowers it; its LLN in this cohort averaged only 60% of predicted, reflecting the very wide normal range that makes it unreliable. We therefore pre-specified both flow indices as exploratory. Their reduction here should not be read as independent evidence of small-airway disease; that would require oscillometry or high-resolution imaging. For the same reason, a low FVC with a preserved ratio cannot be called a restrictive ventilatory defect without plethysmographic confirmation of a reduced TLC[6].

Strengths and Limitations

Strengths include balanced group sizes, rigorous exclusion of smokers and obese participants, frequency-matching for age and sex, strict pre-test preparation, visual inspection of all curves, and the use of a single population-appropriate reference source for every index. Crucially, evaluating abnormality solely through an LLN-based classification removes the confounding effect of arbitrary fixed thresholds.

Limitations remain. The single-centre hospital-based design limits generalisability to community populations. The cross-

sectional design precludes inference about causal sequence or rate of decline. TLC and DLCO were not measured, so restriction is suggested rather than established. Bronchodilator reversibility testing was not performed; ICS-NCCP recommends it (Grade 1A) for anyone with suspected or demonstrated airflow obstruction, though no participant met LLN criteria for obstruction, so the omission is unlikely to affect these results. Analyses are unadjusted and remain open to residual confounding from physical activity, fat distribution, socio-economic status and medication. The reference equations of Chhabra *et al* were derived in Delhi; even within India, regional equations disagree, with north and south Indian equations discordant in 12.9% of records and north and west Indian equations in 22.1%[17,33], so a residual reference-population mismatch cannot be excluded. Finally, that equation set's FEV1/FVC model predicts somewhat lower ratios than its component FVC and FEV1 models imply, which raises FEV1 per cent predicted relative to FVC per cent predicted; this is a property of the reference source rather than of our cohort, and is a further argument for reporting absolute values.

Conclusion

In this hospital-based cohort, non-smoking adults with T2DM had lower FVC and FEV1 than matched controls, with a preserved FEV1/FVC ratio and an LLN-defined low-volume spirometric pattern in 56%, and these deficits tracked with diabetes duration and glycaemic control. When all indices are referenced to a single population-appropriate equation set and abnormality is defined exclusively by the statistically derived LLN, the signal persists with high clinical clarity. The findings are compatible with subclinical pulmonary involvement in diabetes but cannot confirm true restrictive ventilatory defects. Longitudinal studies incorporating TLC, DLCO and z-score interpretation are required to define the trajectory and clinical relevance of diabetic pneumopathy.

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ANNOUNCEMENT

Mrs. Uma Bansal - Prof. B.C. Bansal Best Paper Award (Journal -2026)

Best Original Article – "Evaluation of the Relation between Dialysis Vintage, Cognitive Functions and Functional Status in CKD Patients" – Dr. Shafin Rashad V, Dr. Senthilkumar, Dr. A Venkatesh, Dr. A Jayaprakash, Dr. Shree Sruthi E, Dr. Andrew JS, Dr. Niranjan Yadav – Department of Renal Dialysis Technology, Vinayak Mission's Research Foundation – Deemed to be University, Salem - 636 308, (Tamil Nadu).

Best Review Article – "The Role of Nutrition in Rheumatic Disease – A Global Perspective As Easy AS A, B, Ghee?" – Dr. Dominik Baluch, Dr. Elena Nikiphorou, Dr. Elena Phillippou – King's College London, London, UK.

Best Case Report – "Idiopathic Multicentric Castleman Disease Presenting as TAFRO Syndrome: A Diagnostic Enigma" – Dr. Rajnish Singh, Dr. Shreyasee Patra, Dr. Brijesh Sharma, Dr. Madhubala Negi, Dr. Archana Mohan, Dr. Tanvi Suri, Dr. Shivanshu Gangwar – Department of General Medicine, ABVIMS and Dr. Ram Manohar Lohia Hospital, Baba Kharak Singh Marg, New Delhi - 110 001.