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Original Article

FEV$_1$ and Platelet Parameters in Diabetic Rural School Teachers

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ABSTRACT

Introduction and Aim: Platelets play a crucial role in hemostasis. There are limited studies on altered platelet parameters associated with inflammation in respiratory disorders. FEV1 is widely used as an indicator of lung function. This study aims to investigate the relation between FEV1 and platelet parameters in diabetic rural school teachers for early detection of their respiratory illness. Materials and methods:This random study included 41 rural female diabetic school teachers. The study is approved by Institutional Ethics Committee of GSL Medical College and General Hospital, Rajahmundry.After informed, written consent FEV1 is recorded using portable spirometer. For platelet parameters, the blood samples are collected through venipuncture under aseptic conditions. Platelet parameters including PLT (Platelet count), MPV (Mean platelet volume), PDW-SD (Platelet distribution width-Standard deviation), PDW-VC (Platelet Distribution Width-Variation Coefficient), P-LCR (Platelet-Large Cell Ratio), P-LCC (Platelet-Large Cell Count) are analyzed using an automated analyzer. Correlation between variables is analyzed with Pearson correlation. Results: The mean age of participants is 39.61 ± 6.62 years with BMI of 26.70 ± 4.8 kg/m2. The mean FEV1 is1.622 ± 0.43 lit/min. FEV1 is negatively correlated withBMI ($r=-0.420$, $p<0.01$), while it ispositivewith platelet count (mean=337.65 ± 53.55;$r=0.320$, $p=0.05$). The negative correlationobserved between FEV1 and other platelet parameters suggest their potential inverse relationship. Conclusion: In this study thedecrease in FEV1with increased BMI shown that higher BMI is associated with reduced lung function. However, as platelets release Platelet Derived Growth Factor (PDGF) that can promote lung tissue repair and regeneration, the positive association with platelet count in this study signify the protection of lung parenchyma. Large sample size is warranted for the importance of managing both metabolic and platelet related factors in female diabetic rural teachers to mitigate the risk of respiratory complications.

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Introduction

FEV1 stands for Forced Expiratory Volume in 1 Second, indicating the volume of air a person can forcefully exhale in one second. As FEV1 index the precise values based on the anthropometric data of each individual, it may vary in range according to their sex, height, and ethnicity. The decline of lung function with age also results in decrease of FEV1 values over time.This parameter is key to assess the presence of airway obstruction that can lead to chronic obstructive pulmonary disease (COPD), asthma, and other respiratory conditions.

Diabetes mellitus (DM) is a metabolic disorder that is characterized by chronic hyperglycemia with abnormalities in carbohydrate, lipid and protein metabolism resulting from defects in insulin secretion, action or both [1]. Diabetes is further complicated by accelerated atherosclerosis. Platelet activation plays a key role in inflammation and the athero-thrombosis process contributes to the development of CVD in a patient with T2DM [2].

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Type-2 diabetes (T2DM) associated with obesity, hypertension, dyslipidemia and alterations in hematological parameters, endothelial dysfunction with insulin resistance leading to vascular complications [3,4]. Hematological changes encountered in T2DM patients include changes in the function, structure and metabolism of formed elements and hemostatic mechanisms [5,6].

There has been renewed interest in heamatological parameters such as WBC, red blood cell distribution width (RDW), mean platelet volume (MPV), platelet distribution width, and platelet count as predictors of endothelial dysfunction and inflammation in T2DM [7,8]. MPV is the marker for platelet function [9].

Recent studies have also highlighted the association between diabetes and respiratory complications, including chronic obstructive pulmonary disease (COPD) and asthma [10,11]. Platelet abnormalities, including changes in platelet count and function have also been reported in diabetics [12].

Rural populations, including school teachers, are disproportionately affected due to limited access to healthcare services. However, there are limited studies focused on the relationship between diabetes, lung function, and platelet parameters in rural populations, particularly among school teachers. Accordingly, this study aims to assess the relationship between FEV1 and platelet parameters in diabetic rural school teachers.

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MATERIALS AND METHODS

1)Study design and recruitment

The study is approved by Institutional Ethics Committee (IEC) of GSL Medical College and General Hospital, Rajahmundry.

This random study recruited 41 diabetic rural school teachers aged between 30-60 yrs as subjects through convenient sampling. Inclusion criteria consist of a confirmed diabetes diagnosis and current employment as a school teacher in a rural area while subjects with severe respiratory disease, cardiovascular disease, and in pregnancy or lactation are excluded. Data collection involved a demographic and medical history questionnaire. Correlation between variables is analyzed with Pearson correlation (SPSS trial version).

2)Anthropometric measurements and Sample collection

Anthropometric measurements are recorded following standard procedures. Height is recorded by using a stadiometer and by electronic weighing scale weight is measured. BMI is calculated as weight in kilograms divided by the square of height in meters. Waist-Hip circumference ratio is measured using a flexible tape measure at the midpoint between the lower rib margin and the iliac crest while neck circumference at the level of the cricothyroid membrane. Recording of FEV1 is demonstrated according to the manufacture's manual of portable spirometer (Model Number: SMPF-1). While the subjects seated at rest, three consecutiveFEV1 values are recorded insitting position, and highest value among the three is considered for analysis.

5ml venous blood samples are collected from each participant after an overnight fast of 7 hours. The blood samples are collected in EDTA tubes for platelet parameter measurement and in plain tubes for serum separation. Platelet parameters included PLT (Platelet count), MPV (Mean platelet volume), PDW-SD (Platelet distribution width-Standard deviation), PDW-VC (Platelet Distribution Width-Variation Coefficient), P-LCR (Platelet-Large Cell Ratio), P-LCC (Platelet-Large Cell Count)are measured by automated hematology analyzer. Serum glucose and HbA1c levels are also estimated according to the standard laboratory procedures.

SATISTICAL ANALYSIS

All statistical analyses are undertaken using Pearson correlation. Descriptive statistics summarize the demographic and clinical data. Mean and standard deviation is calculated for continuous variables, while frequencies and percentagescalculated for categorical variables. Pearson correlation coefficient (r) is used to examine the relationships between FEV1 and platelet parameters.

The correlation coefficients are interpreted as follows: r=0-0.3 (weak correlation), r=0.3-0.6 (moderate correlation), and r=0.6-1.0 (strong correlation). A p-value of <0.05 is considered statistically significant.

RESULTS

The mean values of the anthropometric measures of the study participants are presented in Table.1.

Table. 1. Showing the mean values of the anthropometric measures of the study participants

VARIABLE (N=41)	MEAN ± SD
Age (years)	39.610 ± 6.62
Weight (Kg)	68.16 ± 13.34
Height (cm)	159.56 ± 7.76
Neck circumference (cm)	13.610 ± 0.77
Waist (cm)	33.62 ± 4.19
Hip (cm)	41.19 ± 4.19
W/H ratio	0.81 ± 0.05
Mean Arterial Pressure (MAP)	94.09 ± 4.81

Table. 2. Pearson correlation coefficient (r) between FEV1 and anthropometric measures

		Age (yrs)	BMI (Kg/ m2)	W/H ratio	Neck circum-ference (cm)	Mean Arterial Pressure (MAP)
FEV1	Pearson Cor-relation	0.086	-0.420	0.90	-0.216	0.369
	Sig. (2 -tailed)	0.595	0.006	0.574	0.176	0.018

The mean weight (kg) of the subjects is 68.16 ± 13.34 with a BMI of 26.702 kg/m^2 while the mean FEV_1 recorded is 1.622 L/min. A significant negative correlation is observed between FEV_1 with body weight (rho = –0.347, p = 0.05) and BMI (rho = –0.420, p = 0.01). Height (rho = –0.043) and neck circumference (rho = –0.216) did not show statistically significant correlations (p > 0.05) with FEV1.

Table. 3. Pearson correlation coefficient (r) between FEV1 and platelet parameters

		PCT (%)	PLT (10^9/L)	MPV (fl)	PDW-VC (%)	PDW-SD (fl)	PLCC 10^9/L)	PLCR (%)
FEV1	Pear-son Cor-rela-tion	0.203	0.320	-0.303	-0.093	-0.085	-0.028	-0.288
	Sig. (2 -tailed)	0.202	0.041	0.054	0.562	0.598	0.864	0.067

The mean platelet count measured is 337.659 × 10^9/L which is significantly correlated positively with FEV1 (rho = 0.320, p = 0.05), however other platelet parameters including MPV (10.278 fl), PDW-SD (16.461 fl), PDW-VC (14.498%), P-LCR (32.234%) and P-LCC (106.732 × 10^9/L) are not significant with FEV_1 (rho values ranging from –0.028 to –0.303, p > 0.05).

DISCUSSION

This study demonstrates the association between forced expiratory volume in one second (FEV1) and various platelet parameters among rural female diabetic school teachers. The findings indicate that individuals with diabetes and reduced lung function may experience altered platelet activity, which can potentially contribute to the development of vascular and inflammatory complications.

Diabetes mellitus (DM), particularly type 2, is increasingly recognized not only as a metabolic disorder but also as a condition that influences respiratory physiology. The mean FEV_1 value recorded in this study was lower than expected, which is below the reference range of 3.25–2.5 L/ min reported for healthy adult females by the American Thoracic Society reflecting impaired pulmonary function in this specific population [13].

One of the primary contributors to reduced lung function in these individuals appears to be obesity, a common co-morbidity in diabetes. With increase in BMI, exceeding the normal range (18.5–24.9 kg/m^2) as defined by the WHO [14], the decreased FEV1 in this study is consistent with findings from studies by Salome et al. [15] and Chen et al. [16], that the increased BMI is associated with reduced lung volumes and flow rates.

Significant negative correlation of body weight with FEV_1 (rho = –0.347, p = 0.05), which aligns with the findings of Peters et al. [17], where excess body weight was associated with decreased FEV1. Obese individuals experience restricted diaphragmatic motion due to the accumulation of abdominal fat, which leads to a reduction in thoracic volume and lung capacity. Moreover, increased neck circumference associated with obesity may cause partial tracheal obstruction, limiting the efficiency of expiration.

These mechanical limitations are reflected in the decreased FEV_1 values, highlighting the burden of obesity on respiratory health in diabetics. This observation is critical, especially for rural populations here both obesity and diabetes prevalence are rising, and awareness of respiratory complications remains limited.

The analysis of platelet indices indicated notable correlations with FEV1. The mean platelet count recorded was 337.659 × 10^9/L, which falls within the normal range of 150–450 × 10^9/L [18]. Importantly, platelet count showed a positive association with FEV_1, suggesting that higher platelet numbers may correlate with better pulmonary functionwhich is comparable to results observed in a study by Anzueto et al., [19] where the higher platelet counts were mildly associated with better spirometric parameters in diabetics. While elevated platelet counts in diabetics are typically considered as a risk factor for vascular complications due to increased platelet reactivity, this finding might also point toward a reparative role.

Ekizogluet.al., [20] reported a weak, non-significant correlations between platelet activation markers and pulmonary function parameters in diabetics. In our study also other platelet parameters showed no statistically significant correlations with FEV1. Platelets are known to secrete growth factors such as Platelet Derived Growth Factor (PDGF), which plays a significant role in tissue regeneration, including alveolar repair. Therefore, in certain physiological contexts, a higher platelet count might contribute to maintaining or improving lung function by supporting repair mechanisms. However, this reparative potential must be balanced against the risk ofendothelial dysfunction, oxidative stress, and chronic inflammation, which are hallmarks of platelet activation in diabetes.

Conversely, other platelet indices such as Mean Platelet Volume (MPV), Platelet Distribution Width – Standard Deviation (PDW-SD), Platelet Distribution Width – Coefficient of Variation (PDW-CV), Platelet-Large Cell Ratio (P-LCR), and Platelet-Large Cell Count (P-LCC) are all found to have negative correlation with FEV1. These parameters are commonly associated with platelet size, variabilityand activity; and their elevation suggests an ongoing pro-thrombotic or inflammatory state in diabetic individuals.

MPV, which reflects the average size of circulating platelets, is considered a marker of platelet activation [21]. Larger platelets are metabolically and enzymatically more active, producing higher levels of thromboxane A2 and expressing more adhesion molecules. In this study, a higher MPV was associated with reduced FEV1, implying that increased platelet activation might contribute to pulmonary dysfunction, possibly via capillary micro-thrombi, inflammatory damage, or altered vascular tone in the lungs.

Similarly, elevated PDW-SD and PDW-CV reflect heterogeneity in platelet size, which may indicate accelerated platelet turnover or release of immature platelets, both of which are seen in inflammatory and metabolic stress conditions. The inverse correlation of these markers with FEV1 suggests that such platelet irregularities may be linked to microvascular changes or endothelial injury in pulmonary tissue, reducing the efficacy of gas exchange.

The negative correlations of P-LCR and P-LCC with FEV1 further support this pattern. These parameters measure the proportion and absolute count of large, reactive platelets in circulation. Higher values may be indicative of enhanced platelet aggregation potential, associated with increased inflammatory signaling and vascular remodeling, both of which can deteriorate lung structure and function over time.

Overall, the interplay between platelet parameters and lung function as observed in this study reflects a delicate balance between inflammation, vascular health, and regenerative potential. The data support the hypothesis that certain platelet indices may serve as early hematological markers of respiratory decline in diabetic individuals. Notably, in rural populations where routine lung function assessment may not be feasible, monitoring platelet indices could offer a cost-effective approach to identifying individuals at risk for pulmonary complications.

Further research involving larger sample size and multi-center cohorts is warranted to validate these findings and clarify the underlying mechanisms. Longitudinal studies may also help determine whether modifying platelet activity through therapeutic interventions can have a beneficial impact on lung function in diabetes. This is particularly crucial for rural school teachers and similar occupational groups, where early identification and intervention could significantly improve long-term respiratory and cardiovascular outcomes.

CONCLUSION

The study highlights the importance of assessing lung function and platelet activity in this population. The study's findings suggest that diabetic rural school teachers may be at risk of respiratory and cardiovascular complications, emphasizing the need for targeted interventions and frequent monitoring. The results of the study can inform the development of effective prevention and management strategies for diabetes-related complications in rural populations.

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We are pleased to note that some of the findings of this study are presented as poster at the Vellore Endocrinology International Congress (VEIC-2025) endorsed by The Endocrine Society of India, organized by Department of Endocrinology, Diabetes and Metabolism, CMC Vellore, India, Albert Einstein College of Medicine, New York, USA and Tata Institute of Fundamental Research, Hyderabad India on 11th January 2025 at CMC Vellore, where it received constructive feedback and recognition from peers in the field of endocrinology and metabolic research.

CONFLICT OF INTRESET: None

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