ORIGINAL RESEARCH

Investigation of platelet properties in individuals diagnosed with type 2 diabetes mellitus

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ABSTRACT
Aim: Investigation of platelet properties in individuals diagnosed with type 2 diabetes mellitus. **Material and methods:** This study included total of 100 subjects with 70 diabetic (type 2) patients attending the diabetic clinic and 30 non diabetics (control group). The demographic information and clinical details of the patients were recorded including duration of diabetes, family history of diabetes, hypertension, drug history, special reference to any complications or co morbidities. **Result:** The average age of the participants was 59.26±12.27 years. The proportion of males and females was equal, with each gender comprising 50% of the total population. Among the observed patients, a majority of 70% were diagnosed with diabetes, while the remaining 30% were found to be non-diabetic. In the present research, the average PCT levels were determined among participants who had complications, yielding a mean value of 0.31±0.09. Conversely, individuals without complications exhibited an average PCT level of 0.29±0.1. The statistical analysis revealed that the connection between PCT and the occurrence of complications was not found to be significant. The mean MPV among individuals who had complications was 13.94±1.37, which was seen to be greater compared to persons without complications (9.92±1.96) and non-diabetic subjects (8.53±1.72). However, the association between PC and HbA1C was found to be not statistically significant (p value>0.05). **Conclusion:** The majority of patients diagnosed with type II diabetes mellitus have avoidable vascular angiopathies, and timely identification of the gradual activation of coagulation may effectively aid in the management of these vascular disorders. Hence, both MPV and PDW exhibit potential use as prognostic indicators for cardiovascular complications in individuals with diabetes. Both MPV and PDW have the potential to serve as affordable and straightforward laboratory tests for monitoring diabetes mellitus (DM), in addition to HbA1c.
Keywords: MPV, PDW, Diabetes mellitus, HbA1C

INTRODUCTION
Diabetes Mellitus is a prevalent and widespread illness that has reached epidemic proportions on a worldwide scale. The condition is a chronic metabolic syndrome primarily characterised by enduring hyperglycemia. Impaired fasting glucose is a commonly seen glycemic issue among the general population and is recognised as a pre-diabetic condition [1]. The global prevalence of diabetes in the adult population (aged 20-79 years) was estimated to be at 6.4% in 2010, impacting around 285 million individuals. It is projected that this figure will increase to 7.7%, affecting approximately 439 million people by the year 2030 [2]. In the context of India, it has been determined that the number of individuals diagnosed with diabetes exceeds 62 million [3]. Fasting blood glucose, postprandial blood glucose, and HbA1c are commonly used measures for assessing glycometabolic regulation in individuals diagnosed with diabetes mellitus (DM).The user has provided a numerical reference. The occurrence of long-term problems is strongly associated with endothelial dysfunction, mostly resulting from inadequate glycemic management. This factor is the primary contributor to mortality rates and poor quality of life among this particular population [2]. Multiple investigations have elucidated the involvement of platelets as a constituent of the coagulation system in

the initiation of these occurrences. DM is well recognised as a "prothrombotic condition." Platelets of larger size, which include denser granules, exhibit more metabolic and enzymatic activity compared to smaller platelets, hence displaying an elevated propensity for thrombosis [4]. The alterations in mean platelet volume (MPV) and platelet distribution width (PDW) are indicative of the thrombogenic process, therefore suggesting that MPV and PDW may serve as prognostic indicators for vascular problems associated with diabetes mellitus [6]. Higher values of mean platelet volume (MPV), PDW, and P-LCR have been shown to be associated with an increased risk of first vascular problems in patients with diabetes mellitus. These parameters may thus be considered as reliable indicators of vascular events and can be used as a simple and cost-effective method for assessing such occurrences [7]. The examination of platelet characteristics may serve as an indicator for the identification and advancement of problems associated with diabetes mellitus [8]. The objective of this research was to conduct a comparative analysis of platelet parameters between individuals diagnosed with type 2 diabetes and a control group consisting of healthy individuals.

MATERIAL AND METHODS
This study included total of 100 subjects with 70 diabetic (type 2) patients attending the diabetic clinic and 30 non diabetics (control group). Out of 70 diabetic patients, 15 were with complications while 55 were DM with any macrovascular (including coronary artery disease and peripheral vascular disease) or microvascular complication (including nephropathy,

neuropathy and retinopathy. For study group, non insulin-dependent DM (type 2) patients on treatment who gave consent attending the diabetic clinic were included in the study. For study group, male patients with Hb <13gm% and female patients with Hb <12gm%, similarly subjects with leucopenia or leucocytosis, thrombocytopenia or thrombocytosis, hypertriglyceridemia, hypercreatininemia, human immunodeficiency virus (HIV) infection, hepatitis B and C, systemic lupus erythematosus, any hematological disorder, any diagnosed malignancy as well as smokers and pregnant women, and patients who are taking anti-platelet drugs such as aspirin and clopidogrel or on insulin were excluded from the study. For control group, persons with coronary artery diseases were excluded from the study. The demographic information and clinical details of the patients were recorded including duration of diabetes, family history of diabetes, hypertension, drug history, special reference to any complications or co morbidities. Data were entered and analysed in excel sheet of Microsoft. Qualitative data will be expressed in the form of percentages & proportions. Quantitative data will be expressed in the form of mean and standard deviation.

RESULT
In the present research, the majority of participants (59%) fell within the age range of 51-70 years. This was followed by the age range of 41-50 years, which accounted for 21% of the participants. The smallest proportion of participants (4%) belonged to the age groups of 31-40 years and 71-80 years.

Table 1- Socio demographic profile of study subjects

Basic profile		Number	Percentage
Age (Years)	31-40	4	4
	41-50	21	21
	51-60	30	30
	61-70	29	29
	71-80	12	12
	81-90	4	4
Sex	Male	50	50
	Female	50	50
Diabetic	Yes	70	70
	No	30	30
HbA1C	<6.5	31	31
	≥6.5	69	69

The average age of the participants was 59.26±12.27 years. The proportion of males and females was equal, with each gender comprising 50% of the total population. Among the observed patients, a majority of 70% were diagnosed with diabetes, while the remaining 30% were found to be non-diabetic. Among the cohort of 70 individuals diagnosed with diabetes, it was shown that 78.57% of the participants had problems, while only 21.43% were unaffected by such complications. Among the sample of 100

participants, it was observed that 69% exhibited a HbA1C level more than or equal to 6.5, while the remaining 31% displayed a HbA1C level below 6.5. Among a sample of 100 people, it was shown that 55% exhibited problems in conjunction with diabetes, whereas 15% did not manifest any difficulties in association with diabetes. Approximately 30% of the participants did not have diabetes. The study observed a strong correlation between HbA1C and MPV, as well as between HbA1C and PDW, with Pearson's

coefficients of 0.767 and 0.338, respectively (p-value <0.05). The statistical analysis revealed that there was no significant correlation between HbA1C and PCT or PC, as shown by a p-value greater than 0.05.

Table 2- Correlation of HbA1C with platelet parameters

Variable	Pearson's correlation coefficient	p value
PCT(%)	0.113	0.262
MPV (fl)	0.767	<0.001
PDW(fl)	0.338	0.001
PC (cells/cumm)	-0.011	0.967

In the present research, the average PCT levels were determined among participants who had complications, yielding a mean value of 0.31±0.09. Conversely, individuals without complications exhibited an average PCT level of 0.29±0.1. The statistical analysis revealed that the connection between PCT and the occurrence of complications was not found to be significant.

Table 3- Association of Platelet indices among study groups

Variable	Diabetic with complications (n=55)	Diabetic without complications (n=15)	Non- diabetic (n=30)	Test of significance
PCT(%)	0.31±0.09	0.29±0.1	0.26±0.09	F=2.839, df=2, p value=0.063
MPV (fl)	13.94±1.37	9.92±1.96	8.53±1.72	F=126.085, df=2, p value<0.001
PDW(fl)	17.25±2.18	14.55±2.44	14.62±2.65	F=15.584, df=2, p value<0.001
PC (cells/cumm)	319.93±104.86	301.87±141.9	295.67±78.55	F=0.578, df=2, p value=0.563
HbA1c(gm%)	7.85±0.73	6.63±0.14	6.02±0.25	F=107.19, df=2, p value<0.001

The mean MPV among individuals who had complications was 13.94±1.37, which was seen to be greater compared to persons without complications (9.92±1.96) and non-diabetic subjects (8.53±1.72). This correlation was determined to be statistically significant (p value<0.05). The mean PDW among individuals who had complications was 17.25±2.18, which was found to be larger compared to people without complications (14.55±2.44) and non-diabetic subjects. This connection was shown to be statistically significant, with a p-value less than 0.05. The association between HbA1C and complications was shown to be statistically significant, with a p-value of less than 0.05. In the fourth table (Table-4), the data is presented in a tabular format The prevalence of PCT, MPV, and PDW was higher among people with a HbA1C level more than or equal to 6.5 compared to patients with a HbA1C level less than 6.5. The study revealed a statistically significant connection between HbA1C levels and PCT, MPV, and PDW (p value<0.05). However, the association between PC and HbA1C was found to be not statistically significant (p value>0.05).

Table 4- Association of Platelet indices with HbA1C among study participants

Variable	HbA1C		Test of significance
	<6.5gm% (n=31)	≥6.5gm% (n=69)	
PCT(%)	0.26±0.09	0.31±0.09	t=-2.5, df=98, p value=0.014
MPV (fl)	8.53±1.69	13.14±2.19	t=-10.4, df=98, p value<0.001
PDW(fl)	14.6±2.61	16.71±2.48	t=-3.882, df=98, p value<0.002
PC (cells/cumm)	293.52±78.16	317.32±113.23	t=-1.061, df=98, p value=0.291

DISCUSSION

Diabetes mellitus is a chronic disease that causes increased morbidity and mortality due to its vascular complications. There is a need to develop risk factor modification to reduce the impact of complications. There is increased risk of thrombosis and atherogenesis in diabetic patients. Changes in hemostatic balance have been an important pathogenetic factor contributing to development of complications in DM. The present study was conducted to compare platelet parameters in type 2 diabetic patients and healthy controls, which can also be used as a good indicator of platelet activation and an independent predictor of impending vasculitis. In present study age ranged from 36 to 89 years with diabetic complication was more prevalent in 5th decade followed by 6th and 4th decade. The mean age of patients in present study is 59.2±12.2. Similar findings were observed in study carried out by Akinsegun et al who found mean age of patients was 62.35±9.84 years[9]. In present study 50% of patients were male and 50% patients were females with male to female ratio in 1:1. Finding were in concordance with Hasan et al who found 55% males and 45% females[10]. In present study 31% had HbA1c level less than 6.5 and 69% cases had HbA1c level 6.5 or

more than 6.5, while Sushma et al 97.2% cases had HbA1c level more than or equal to 6.5 and only 2.8% had HbA1c level < 6.5[11]. This can be attributed to selection of cases Our study shows a statistically significant difference in the MPV level in diabetic patients with and without complications when compared to uncomplicated cases Dubey et al found that Mean platelet volume is 10.62±2.13 fl in diabetic group with vascular complications which is found to be raised in comparison to the group without vascular complications which is statistically significant with p value <0.0001[12]. In present study mean PCT in DM with complications is 0.31±0.09 and without complication is 0.29±0.10 and in non-diabetic cases is 0.26±0.09. The p-value between non-diabetic and diabetic with complication is 0.063 which is statistically insignificant. Similarly. A study by Mardia et al[13] revealed Mean PCT of 0.29 in diabetic without complication and mean PCT 0.43 in patients with complications (p value=0.007). In present study a statistical significance in mean PDW level was observed in cases of diabetes. The p-value between non-diabetic and diabetic with complication was 0.0001 which is statistically significant. The observations were in concordance with Jindalet al[14]. These findings can be attributed to the accelerated production of platelets in patients with T2DM. In present study mean PC in DM with complications is 319.9±104.8 and without complication is 301.8±141.8, the difference being statistically insignificant 0.563. The findings are quite similar to study by Mardia et al[13] who found platelet counts higher in the diabetic with complications.

CONCLUSION

The majority of patients diagnosed with type II diabetes mellitus have avoidable vascular angiopathies, and timely identification of the gradual activation of coagulation may effectively aid in the management of these vascular disorders. Hence, both MPV and PDW exhibit potential use as prognostic indicators for cardiovascular complications in individuals with diabetes. Both MPV and PDW have the potential to serve as affordable and straightforward laboratory tests for monitoring diabetes mellitus (DM), in addition to HbA1c.

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