



EVALUATION OF VARIATION IN PLATELETS INDICES AMONG PATIENTS WITH DIABETES MELLITUS

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ABSTRACT

Diabetes mellitus is a persistent metabolic disease that is associated with continuous hyperglycemia that predisposes the patient to serious microvascular and macrovascular diseases. Platelet activation is a key process that facilitates thrombosis and vascular injury in diabetic subjects among other factors that lead to these complications. Platelet indices including Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and Plateletcrit (PCT) indicate valuable data regarding the size of platelets, variability and mass of platelets, and a change in platelet indices usually shows an improved platelet reactivity and dysfunction. These parameters are measured regularly in complete blood counts, and these parameters may become more ready and inexpensive indicators of the risk of thrombosis in clinical practice. The proposed research is expected to assess and compare these platelet indices in diabetic patients and investigate their relationship with the glycemic status, including the levels of fasting blood glucose and HbA1c. Moreover, the experiment examines the relationship between changes in indices of platelet and the duration and intensity of diabetes and thus evaluates whether they can be used as signs of disease progression and vascular risk. The knowledge of such relationships can help to identify high-risk patients earlier and implement platelet indices into regular monitoring to improve patient management and prevent the development of diabetic complications.

Keywords: *Diabetes mellitus; Platelet indices; Mean Platelet Volume; Platelet Distribution Width; Glycemic control*



INRODUCTION

Diabetes mellitus is a persistent metabolic condition that is characterized by continuous hyperglycemia caused by impairments in insulin secretion, insulin activity or both. The incidence of diabetes has increased drastically across the globe in the past decades and is therefore a serious health issue to people. The problem has numerous long-term complications, which are related to multiple organ systems. Table 1. Microvascular complications like retinopathy, nephropathy and neuropathy, and macrovascular complications like cardiovascular disease, stroke and peripheral vascular disease increase the morbidity and mortality of diabetic patients. These complications have a progressive development, which is affected by various factors such as the duration of hyperglycemia, oxidative stress, inflammation, and metabolic imbalance that result in impaired vascular damage.

Platelet dysfunction and intensified platelet activation is among the complex processes that induce diabetic complications and contribute to the occurrence of thrombotic events. The morphology and reactivity of platelets of diabetic patients tend to be distorted and hyperactivated and therefore, prone to aggregation and clotting. The endothelial dysfunction, chronic inflammation, and augmented oxidative stress are additional contributors of the prothrombotic tendency, which are typical in diabetes. Thus, it is crucial to learn about platelet behavior in diabetes as it can be used to predict the risk of their vascular complications and enhance clinical outcomes by means of early intervention.

Hematological parameters like Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Plateletcrit (PCT) are regularly measured platelet-related parameters that display the size of platelets, their heterogeneity, and platelet mass. Bigger platelets and a more broad size range are viewed as the indicators of platelet activation and the increase in their aggregation capacity. Morphological and functional alterations of platelets can be a result of chronic hyperglycemia and metabolic alterations in diabetic patients, which become the causes of vascular complication. Although these indices are of clinical importance, they are not commonly used as diagnostic and prognostic factors in a clinical setting. The comparison of the platelet indices changes and their correlation with glycemic control, duration, and severity of the disease can be useful in the

establishment of the prothrombotic state in diabetes. This assessment can also assist in revealing high-risk patients through simple cost-effective laboratory tests and prioritize the risks and manage them appropriately in the clinics.

1.1 Research Objectives

- However, the purpose of the study is to assess the differences in platelet indices (MPV, PDW, and PCT) of patients with diabetes mellitus.
- To evaluate the relationship between indices of platelets and glycemic control represented by the level of fasting glucose in the blood and the level of HbA1c.
- To examine the correlation between platelet indices and the course of diabetes mellitus and the length and degree of course.
- To identify the potential of the platelet indices as cost-effective hematological indices to predict thrombotic risk and vascular complications in diabetic patients.

LITERATURE REVIEW

Dwivedi and Davangeri (2018) carried out a hospital observational study to determine the differences in platelet indices in clients of a tertiary care unit with diabetes mellitus. The experiment compared the platelet parameters of diabetic and non-diabetic controls and indicated that Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) was significantly higher in diabetic patients. The findings indicated a potential increase in the platelet activation and morphological alterations through chronic hyperglycemia. The authors highlighted that platelet indices are the easy to access and cost-effective hematological issues that can be utilized as meaningful indicators of platelet functioning and thrombotic risk in diabetic individuals.

Shilpi and Potekar (2018) compared the platelet indices of patients with type 2 diabetes mellitus and compared them with the glycemic parameters, such as the levels of fasting blood glucose and HbA1c. Their results were that diabetic patients had an increased level of MPV and PDW; as well as, poor-glycemic controlled diabetic patients. The authors found that the change in platelet indices in diabetes indicated high platelet reactivity and aggregation, which in turn, may predispose patients to vascular complications. The authors had proposed that regular observation of these



indices could help in the prompt identification of thrombotic risk and enhance clinical treatment of patients with type 2 diabetes.

Taderegew et al. (2021) carried out a cross sectional study in northeast Ethiopia to determine platelet indices and their relationship with microvascular complications in individuals with type 2 diabetes mellitus. The research documented very high MPV, PDW and Plateletcrit (PCT) in patients with microvascular complications (retinopathy, nephropathy or neuropathy (or all three)) than those without complications. These findings, as analyzed by the authors, were evidence that platelet activation and morphological alteration was more evident on patients with advanced disease and complications. They postulated that platelet indices could offer a good predictor of microvascular involvement and that they could be used to aid early intervention measures.

Ali and Hassan (2019) assessed the change in the different parameters of the blood in diabetic patients with type 2 diabetes mellitus in a cross sectional study. The findings indicated that there are major variations in platelet indices relative to healthy controls indicating a pro-thrombotic tendency and distorted hematologic profile among diabetic individuals. These hematological changes, as noted by the authors, might be attributed to chronic inflammation, endothelial dysfunction and metabolic imbalances that are relative to diabetes. The authors accentuated the clinical relevance of regular hematological parameters as a disease progression and vascular risk evaluation of diabetic patients.

Jiskani and Singh (2021) examined the potential of platelet indices as biomarkers of glycemic and progression of complications in type II diabetes mellitus patients. Their research has established that high platelet parameters, especially MPV and PDW, were strongly linked with poor glycemic control and high risk of diabetic complications. The authors talked about the fact that such indices might indicate increased platelet activation caused by chronic hyperglycemia and oxidative stress. They concluded that the platelet indices might be used as simple, low cost hematology variables to track the disease progress, gauge the treatment response, and vascular risk in diabetic patients, particularly in low resource-rich environments.

Mirghani (2025) presented an extensive literature review of the clinical applications of platelet indices to diabetes mellitus, with a special focus on the possibility of these indices being used as



indicators of disease progression and vascular events. The article has explained the relationship between the change in the platelet parameters including MPV, PDW and PCT and unstable glycemic control and high platelet activation in diabetic patients. It emphasized that high platelet indices were usually found in people with established diabetes and those that had microvascular or macrovascular complications. The author further stressed the utility of platelet indices as cheap and available biomarkers in the daily clinical practice, particularly in resource-restricted environments, and proposed that the indices may be helpful in predicting risks and evaluating diabetic complications early.

RESEARCH METHODOLOGY

The next section describes the research methodology employed in this study and it will consist of the study design, setting, sample selection, data collection procedures, variables, and statistical analysis. This methodological strategy was used to make sure that the platelet indices in diabetic patients were properly evaluated and that the correlation with glycemic status and the features of the disease was reliable.

Research Design

The current study embraced a cross-sectional observational research design since it was conducted at a hospital to assess the difference in platelet indices among diabetic patients. This design was taken to gauge the parameters of hematology and how they relate with the glycemic status at one instance in time.

Study Area and Sample Size

The research involved a working unit that was the Department of Pathology and the Department of Medicine in a tertiary care teaching hospital. The study included 100 patients who were diagnosed with diabetes mellitus. The convenience sampling technique was applied to select the patients visiting the outpatient and inpatient departments within the study period. The inclusion criteria included adult patients having confirmed diabetes mellitus, and patients who have known hematological conditions, acute infections, inflammatory processes, and individuals who are on antiplatelet therapy were excluded due to confounding factors.



Data Collection Method

Informed consent was given after which relevant demographic and clinical information including age, sex, diabetes duration, and treatment history was documented using a structured proforma. Aseptic collection of venous blood samples was done. Platelet indices such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Plateletcrit (PCT) were measured with the help of an automated hematology analyzer. The level of glucose in the blood and the value of glycated hemoglobin (HbA1c) in the laboratory records were used to determine the level of glycemic status.

Variables and Measurement

The independent variables were the age, gender, and the duration of diabetes, the level of fasting blood glucose, and the level of HbA1c. Platelet indices, i.e. platelet MPV, platelet PDW and platelet PCT, were the dependent variables. Measurement of all laboratory parameters was done by use of standardized procedures and calibration equipment to provide precision and consistency of results.

Data Analysis

The statistical data collected were put into a spreadsheet and examined using Statistical Package to Social Sciences (SPSS) software. Data were summarized by descriptive statistics like mean, standard deviation, frequency and percentages. The inferential statistics tests such as independent t-test and Pearson correlation analysis were conducted to evaluate the changes in the platelet indices and their relationship with the glycemic condition and years of diabetes. The p-value below 0.05 was found to be statistically significant.

RESULT AND DISCUSSION

The age distribution of the research participants is given in Table 1. The statistics show that most of the patients fell into middle-aged and old age bracket (two-thirds 34 and 28 respectively). The number of those who were aged 60-70 years (26%), 30-39 years (12%), and above was also quite high. This distribution indicates that diabetes mellitus was commoner in the study population in

the older age groups and the age factor increases the susceptibility to diabetes with age. The diffuse representation of the middle-aged and elderly populations is also a possible sign of prolonged disease and cumulative exposure to risk factors like sedentary lifestyle, obesity, and changes in metabolism.

Table 1: Age Distribution of Participants

Age Group (Years)	Frequency (n)	Percentage (%)
30–39	12	12%
40–49	28	28%
50–59	34	34%
60–70	26	26%

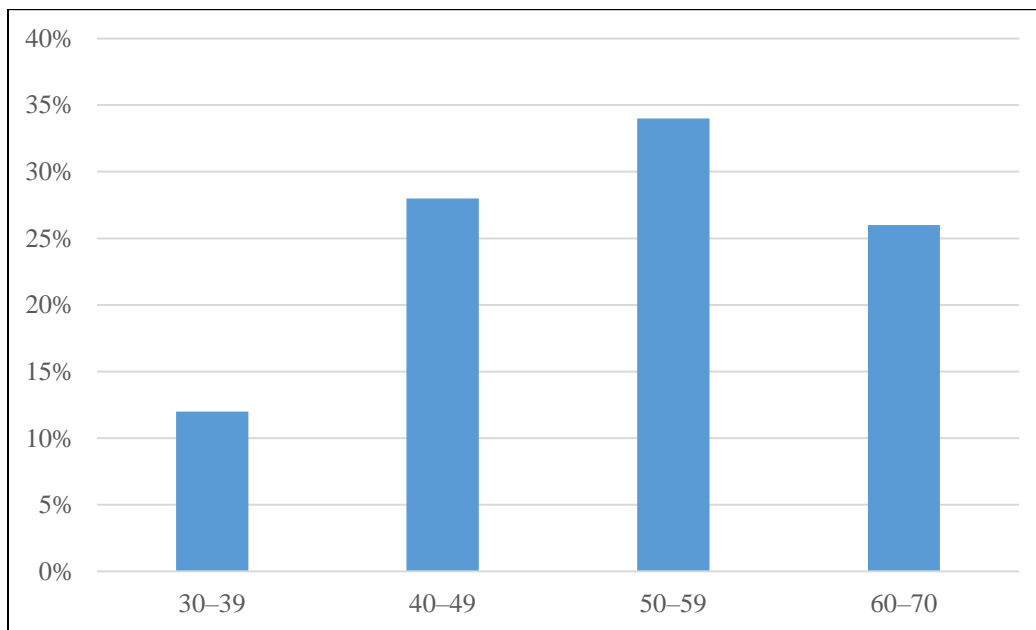


Figure 1: Graphical Representation on Age Distribution of Participants

The age structure indicates that diabetes mellitus was higher among those in the 50 to 59 years age bracket, and this also agrees with the generally accepted fact that diabetes tends to rise with age. This increased prevalence rate among the middle-aged and older age groups could be due to a long period of exposure to risk factors, including sedentary living, poor diets, obesity and age-associated metabolic alterations, which make an individual disposed to insulin resistance. Moreover, older people tend to have a greater disease-period, which increases the diagnosis rates. The reduced proportion of patients in the 30-39 years age bracket implies that there are relatively fewer young adults with diabetes in the study population which could be due to the slow development of type 2 diabetes and reduced screening among young people.

The table 2 shows the types of treatments applied by the participants in the study. Most of the patients (62%), were treated using oral hypoglycemic agents, which means that most of them were probably diagnosed with type 2 diabetes and were at the early or moderate stages of the disease. Insulin therapy was administered to 28% of the patients and this could be an indication of more advanced disease, inadequate glycemic control or prolonged duration of the disease. A smaller percentage of the participants (10) were on a combination therapy, which entailed a combined use of oral medication, as well as insulin, indicating that in instances where monotherapy failed, the development of intensified treatment is necessary. Such distribution emphasizes the different treatment needs of diabetic patients with regard to disease severity and glycemic control.

Table 2: Treatment Type among Participants

Treatment Type	Frequency (n)	Percentage (%)
Oral hypoglycemic agents	62	62%
Insulin therapy	28	28%
Combination therapy	10	10%

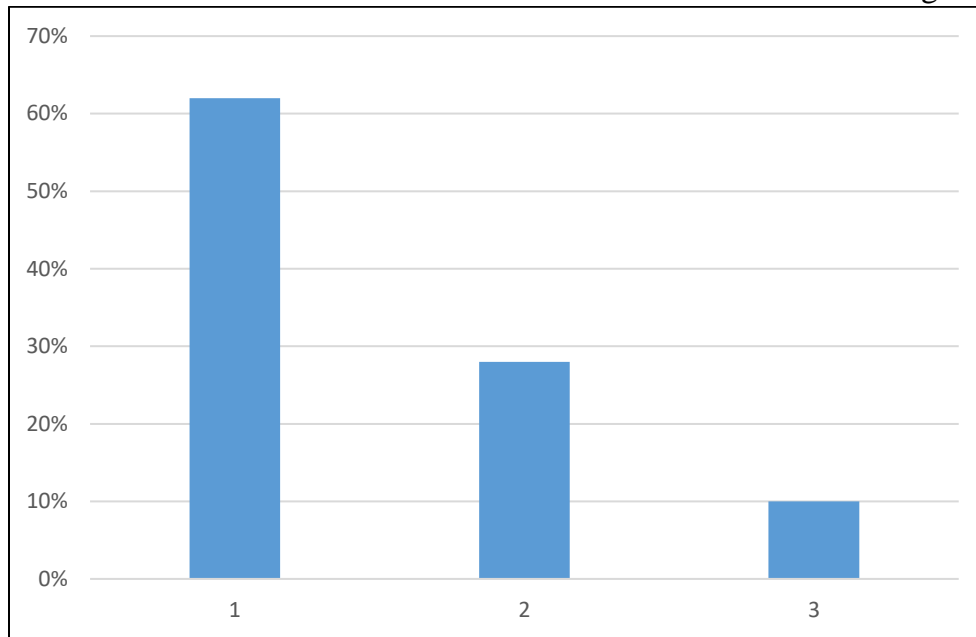


Figure 2: Graphical Representation on Treatment Type among Participants

The way the types of treatment have been distributed indicates that the majority of diabetic patients in the research were treated using oral drugs which points to the fact that the majority of diabetes was type 2 and possibly earlier phases of the disease when oral treatment can be used. The relatively high percentage of patients taking insulin therapy (28) could be due to cases of poor glycemic control, increased length of diabetes or a more progressive disease that requires more intensive treatment. The low percentage in combination therapy shows that only a small percentage of patients had to go on to intensified therapy which is commonly required when monotherapy is not able to keep the glycemic levels up to satisfactory standards. On the whole, the given distribution reveals the differences in the severity of diabetes between participants and implies that the treatment needs were dependent on the progression of the disease and its controlled condition.

Table 3 illustrates the index of platelet between the participants and they are classified either as normal or high within standard reference intervals. The findings showed that 58 percent of patients showed high MPV, which implies more platelet size and activation whereas 42 percent showed normal MPV. On the same note, 54% of all patients exhibited high PDW, giving more variation to the platelet size, as opposed to 46% of patients that had normal PDW. In the case of PCT, 51

percent of patient’s recorded elevated values indicating that the platelet mass is increased whilst 49 percent recorded normal values. Altogether, the results indicate that the percentage of diabetic patients with a change in platelet indices was quite high and could prove more active platelets and an increased risk of thrombotic complications.

Table 3: Platelet Indices Categories (Normal vs Elevated)

Platelet Index	Normal	Elevated
MPV	42%	58%
PDW	46%	54%
PCT	49%	51%

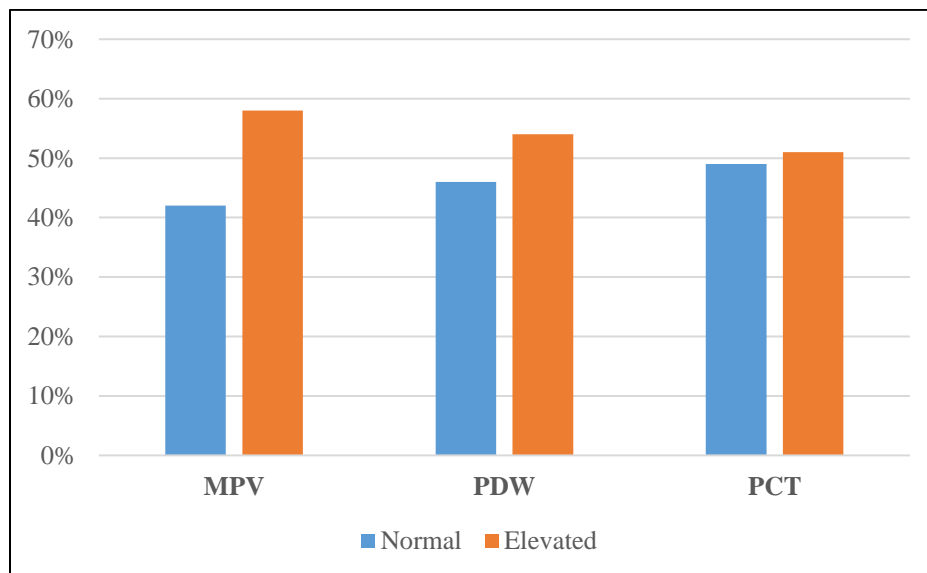


Figure 3: Graphical Representation on Platelet Indices Categories (Normal vs Elevated)

The increased percentage of high platelet indices indicates that most of the diabetic patients in this research had high platelet activity and morphological alterations, which are known to cause a prothrombotic condition. High MPV and PDW is indicative of increased and more varying platelet sizes which means that platelets were more activated and susceptible to aggregation. These

alterations are usually related to augmented platelet activation through protracted hyperglycemia and oxidative stress. This observation suggests that patients with diabetes are at increased risk of vascular complications like atherosclerosis, thrombosis and microvascular damage. The fact that the proportion of normal and high PCT values are almost equal to each other indicates that changes in the total platelet mass are moderate, but it also indicates the existence of the altered platelet functioning in diabetes. These findings highlight the significance of a regular observation of platelet indices as a simple and affordable indicator of risk of thrombotic in diabetic patients.

Table 4 indicates how platelet indices are related to fasting blood glucose levels of the participants. Patients were categorised into three levels of fasting blood glucose: <126 mg/dL (25 patients), 126-180mg/dL (50 patients) and >180mg/dL (25 patients). The average values of MPV, PDW, and PCT were gradually incremental in these groups, and the highest values were determined in the patients whose level of fasting blood glucose exceeded 180 mg/dL. This tendency indicates that there is an evident correlation between deteriorating glycemic control and high platelet indices. The patients exhibiting elevated levels of fasting glucose showed bigger and more reactive platelets which showed increased platelet activation. These results suggest that inadequate glycemic control can also lead to morphological alterations in platelets which would only make diabetic patients more prone to the development of vascular complications.

Table 4: Platelet Indices in Relation to Fasting Blood Glucose

Fasting Blood Glucose	Frequency (n)	MPV (Mean ± SD)	PDW (Mean ± SD)	PCT (Mean ± SD)
< 126 mg/dL	25	9.6 ± 0.8	14.2 ± 1.3	0.20 ± 0.02
126–180 mg/dL	50	10.7 ± 1.0	15.5 ± 1.7	0.24 ± 0.04
> 180 mg/dL	25	11.6 ± 1.2	16.8 ± 1.9	0.28 ± 0.05



The data show a definite direction of rising platelet indices with the rise in the level of fasting blood glucose. The better the fasting glucose of patients, the higher the MPV, PDW and PCT values which indicate better activation and size heterogeneity of platelets in poorly controlled diabetes. This correlation suggests that platelet structural and functional alterations could be caused by chronic hyperglycemia via oxidative stress, inflammation, and endothelial dysfunction. Since platelet activation is the central pathway of diabetic vascular complications, the trend can be used to suggest a greater thrombotic risk in uncontrolled blood glucose patients. Thus, platelet indices may be considered as simple and easily affordable indicators of tracking glycemic control and the risk of developing vascular complications in diabetic patients, especially in caring facilities with limited resources where sophisticated diagnostic methods might not be easily accessible.

CONCLUSION

The current study demonstrated that platelet indices, that is, MPV, PDW and PCT are often increased in patients with diabetes mellitus, particularly those having poor glycemic controls and increased length of illness. It can be inferred that chronic hyperglycemia can cause an increase in platelet activation, consequently, producing larger and more heterogeneous platelets that are more likely to aggregate and form thrombus. These platelet morphological and functional alterations are indicative of prothrombotic state which contributes majorly to the emergence of both the microvascular and macrovascular complications in diabetes. Notably, the analysis revealed the gradual rise of the platelet indices with high levels of fasting blood glucose, which supports the close association between hyperglycemia and platelet dynamics deviation. Such results highlight the significance of the optimal glycemic control in order to mitigate platelet activation and related vascular danger. In general, the literature confirms the use of platelet indices as inexpensive, easy to use, and available hematological indices that could be utilized to help in detecting and assessing risks and monitoring diabetic patients. Periodic review of these indices can assist clinicians to detect high-risk persons and undertake pragmatic measures towards preventing or controlling diabetic vascular complications in a more efficient and reasonable manner.

REFERENCES

1. Ali, M. H., & Hassan, A. J. (2019). Assessment of the alteration of blood indices in patients with type 2 diabetic mellitus: a cross-sectional study. *Mustansiriya Medical Journal*, *18*(1), 24-29.
2. Antwi-Baffour, S., Kyeremeh, R., Boateng, S. O., Annison, L., & Seidu, M. A. (2018). Haematological parameters and lipid profile abnormalities among patients with Type-2 diabetes mellitus in Ghana. *Lipids in health and disease*, *17*(1), 283.
3. Arai, T., Atsukawa, M., Tsubota, A., Mikami, S., Haruki, U., Yoshikata, K., & Iwakiri, K. (2022). Antifibrotic effect and long-term outcome of SGLT 2 inhibitors in patients with NAFLD complicated by diabetes mellitus. *Hepatology communications*, *6*(11), 3073-3082.
4. Arkew, M., Yemane, T., Mengistu, Y., Gemechu, K., & Tesfaye, G. (2021). Hematological parameters of type 2 diabetic adult patients at Debre Berhan Referral Hospital, Northeast Ethiopia: A comparative cross-sectional study. *PloS one*, *16*(6), e0253286.
5. Atak, B., Aktas, G., Duman, T. T., Erkus, E., Kocak, M. Z., & Savli, H. (2019). Diabetes control could through platelet-to-lymphocyte ratio in hemograms. *Revista da Associação Médica Brasileira*, *65*, 38-42.
6. Dwivedi, T., & Davangeri, R. (2018). Variation of platelet indices among patients with diabetes mellitus attending tertiary care hospital. *J Clin Diagn Res*, *12*(11), 22-26.
7. Jiskani, S. A., & Singh, D. (2021). Platelets indices as biomarkers of glycemic control and progression of complications in patients of diabetes mellitus type II. *Journal of Haematology and Stem Cell Research*, *1*(1), 21-24.
8. Mirghani, H. O. (2025). Platelets indices clinical implications in diabetes mellitus: A broader insight. *World Journal of Diabetes*, *16*(4), 100467.
9. Pogorzelska, K., Krętowska, A., Krawczuk-Rybak, M., & Sawicka-Żukowska, M. (2020). Characteristics of platelet indices and their prognostic significance in selected medical condition—a systematic review. *Advances in medical sciences*, *65*(2), 310-315.
10. Pordzik, J., Jakubik, D., Jarosz-Popek, J., Wicik, Z., Eyileten, C., De Rosa, S., & Postula, M. (2019). Significance of circulating microRNAs in diabetes mellitus type 2 and platelet reactivity: bioinformatic analysis and review. *Cardiovascular diabetology*, *18*(1), 113.



11. Sadeghi, F., Kovács, S., Zsori, K. S., Csiki, Z., Bereczky, Z., & Shemirani, A. H. (2020). Platelet count and mean volume in acute stroke: a systematic review and meta-analysis. *Platelets*, 31(6), 731-739.
12. Shilpi, K., & Potekar, R. M. (2018). A study of platelet indices in type 2 diabetes mellitus patients. *Indian Journal of Hematology and Blood Transfusion*, 34(1), 115-120.
13. Taderegew, M. M., Woldeamanuel, G. G., Emeria, M. S., Tilahun, M., Yitbarek, G. Y., & Zegeye, B. (2021). Platelet indices and its association with microvascular complications among type 2 diabetes mellitus patients in northeast Ethiopia: a cross-sectional study. *Diabetes, Metabolic Syndrome and Obesity*, 865-874.
14. Walinjkar, R. S., Khadse, S., Kumar, S., Bawankule, S., & Acharya, S. (2019). Platelet indices as a predictor of microvascular complications in type 2 diabetes. *Indian journal of endocrinology and metabolism*, 23(2), 206-210.
15. Zhu, X., Cao, Y., Lu, P., Kang, Y., Lin, Z., Hao, T., & Song, Y. (2018). Evaluation of platelet indices as diagnostic biomarkers for colorectal cancer. *Scientific reports*, 8(1), 11814.



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