

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Comparison Of Mean Platelet Volume In Type II Diabetes Patients Receiving Insulin Therapy And Oral Hypoglycemic Agents.

Madikonda Sai Nithin Rao¹, Sanjeev Kumar Nilakantappa Benteor^{2*},
Rajani Kuchanur³, and Ravi Kattimani⁴.

¹Junior Resident, Department of General Medicine, BLDE (Deemed to be University), Vijayapura, Karnataka, India.

²HOD & Professor of General Medicine, Department of General Medicine, BLDE (Deemed to be University), Vijayapura, Karnataka, India.

^{3,4}Assistant Professor, Department of General Medicine, BLDE (Deemed to be University), Vijayapura, Karnataka, India.

ABSTRACT

In India, Diabetes mellitus is fast reaching the status of epidemic. In addition to macrovascular involvement, patients are at risk of developing microvascular complications such as retinopathy, nephropathy, and neuropathy, all of which have substantial morbidity rates. The primary causes of all diabetic problems are elevated platelet response and increased resistance to insulin. Recent studies have revealed that the mean volume of platelets is an important predictor of atherothrombosis as well as thromboembolism. Ninety patients were selected as study subjects, of whom 30 Type II Diabetes Mellitus patients were on oral hypoglycemic agents, the other 30 were on insulin therapy, and another 30 were non-diabetic patients used as a control for the study. Their mean platelet volume was compared, and their association was documented. Out of 90 primary age groups, patients were in the 40–60 year age group. Females account for 9 and 14 patients in the OHA and insulin groups, respectively. Males account for 21 and 16 patients in the OHA and insulin groups, respectively. The mean of the MPV in OHA (Group 1), Insulin (Group 2), and control population (Group 3) was 12.260, 10.110, and 10.260, respectively. Comparing the results, we found conclusive evidence that the volume of Mean Platelet (MPV) had higher values in patients on OHA treatment compared to patients using insulin and hostile control groups. The volume of Mean Platelet is a simple, inexpensive marker for type II diabetics. It can predict future atherothrombotic and thromboembolic events and forecast the need for statins or switching therapy to insulin.

Keywords: Mean Platelet Volume, Type II Diabetes Patients, Insulin Therapy

<https://doi.org/10.33887/rjpbcs/2024.15.4.44>

**Corresponding author*

INTRODUCTION

A class of metabolic disorders that includes problems with protein, lipid, and glucose metabolism is known as diabetes mellitus. It is characterised by consistently elevated blood sugar levels, which can be brought on by defective insulin secretion, inappropriate action, or both. Diabetes mellitus encompasses two distinct forms: type 1 (dependent on insulin) and type 2 (non-insulin-dependent). According to WHO estimates, diabetes will be the seventh leading cause of death in the world by 2030 [1]. A novel and risk marker for atherothrombosis, Ischemic and coronary Heart disease is mean platelet volume (MPV) [2]. In the development of CVD, platelets play a crucial role [3]. Mean platelet volume (MPV), one of the platelet indices, is a biological indicator of platelet activity and function that estimates the average size of platelets [4]. Giant platelets are more thrombogenic than smaller ones because they have more dense granules and are thus more potent [5]. Platelets may contribute to the altered morphology and function in diabetic individuals and heightened risk of developing micro and macrovascular diseases [6,7]. Numerous studies have shown increased MPV as a risk factor for stroke, myocardial infarction, and transient ischemic episodes. [8,9]. This study aimed to examine the relationship between MPV and DM and distinguish between MPV in patients receiving insulin treatment and those on oral hypoglycemic medications.

MATERIAL AND METHODS

The study was conducted on 60 patients with type II diabetes mellitus and 30 hostile control groups from September 2022 to April 2024 in OPD and IPD patients at Shri B.M. Patil Medical College Hospital and Research Centre, Bijapur Lingayat District Education (BLDE), Vijayapura. The socio-demographic data was obtained using a face-to-face interview. Ninety individuals were randomly assigned into three groups of 30 patients each; group one included patients with type II diabetes mellitus on Oral Hypoglycemic therapy; group two included 30 type II diabetes mellitus patients who are on insulin therapy, and group three included a negative control group. Then Patients were tested for HBA1C, Fasting Blood Sugar, Mean Platelet Volume(MPV) and study groups are compared based on MPV on Diabetic Population with and without treatment. It was a Prospective cross-sectional study and the data will be analysed statistically after being entered into a Microsoft Excel sheet (Version 20).

Inclusion criteria: Reported cases of Type II Diabetes who have been on oral hypoglycemic and insulin therapy for six months.

Exclusion criteria: patients with Type I Diabetes; abnormal platelet counts (thrombocytosis or thrombocytopenia); and on medication such as antiplatelet (Aspirin, Ticagrelor or Clopidogrel)

RESULTS

Current study was done on 90 patients, out of which 60 patients were diagnosed with type II diabetes mellitus and 30 other hostile control groups. Out of 90 major age groups, patients were in the 40-60 year age group; females account for 9 and 14 patients; Males account for 21 and 16 patients in the OHA and Insulin groups, respectively

Table 1: Sex & Age comparison in OHA, Insulin & Control group

Gender	FEMALE	MALE	Total	Chi square test	Significance value
OHA	9	21	30	2.010	0.366
	27.3%	36.8%	33.3%		
INSULIN	14	16	30		
	42.4%	28.1%	33.3%		
CONTROL	10	20	30		
	30.3%	35.1%	33.3%		
Total	33	57	90		
	100.0%	100.0%	100.0%		

Statistically Insignificant

Figure 1: Bar chart showing sex & age distribution among OHA, Insulin & Control Groups

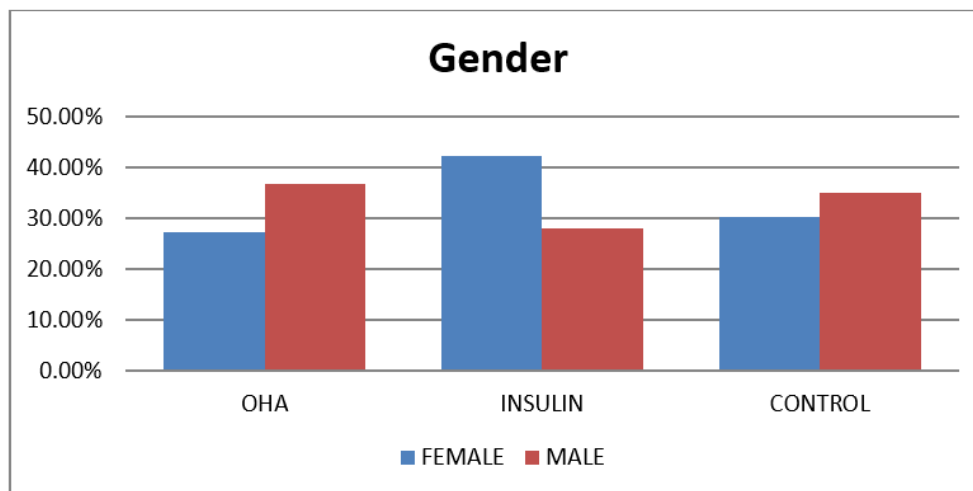


Table 2: Mean Of The MPV With Kruskal Wallis Test In OHA, Insulin & Control Group

MEAN PLATELET VOLUME	Mean	Std. Deviation	95% Confidence Interval for Mean		Kruskal-Wallis Test	Significance value
			Lower Bound	Upper Bound		
OHA	12.260	1.3072	11.772	12.748	25.373	P=0.001*
INSULIN	10.110	1.4003	9.587	10.633		
CONTROL	10.123	1.1252	9.703	10.543		

Statistically significant

Table 3: Pair wise comparison between three groups

Pair wise Comparisons of Groups	Significant value	Remark
CONTROL VS INSULIN	P=0.896	Statistically Insignificant
CONTROL VS OHA	P=0.0001	Statistically significant
INSULIN VS OHA	P=0.0001	Statistically significant

Figure 2: Box & whisker plot comparing MPV in OHA, Insulin & Control Group

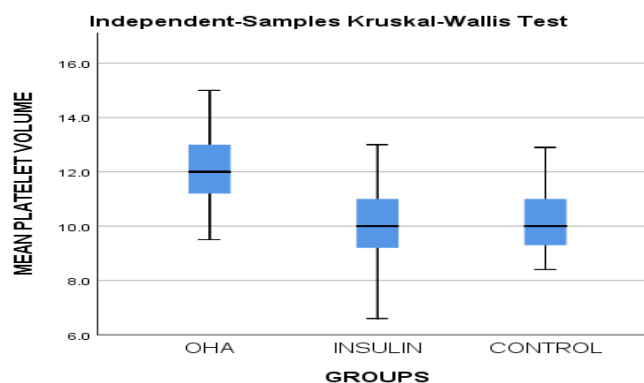


Figure 2: Box & whisker plot comparing MPV in OHA, Insulin & Control Group

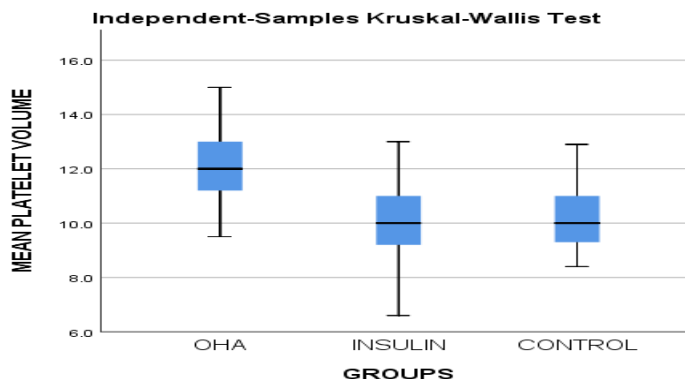


Table 3: Mean HBA1C Comparison between OHA, insulin, control groups

HBA1C(%)	Mean	Std. Deviation	95% Confidence Interval for Mean		Kruskal-Wallis Test	Significance value
			Lower Bound	Upper Bound		
OHA	10.2867%	2.46181%	9.3674%	11.2059%	3.611	P=0.04*
INSULIN	11.8067%	3.04018%	10.6714%	12.9419%		
CONTROL	5.3233%	0.46586%	5.1494%	5.4973%		
Statistically significant						

Table 4: Post hoc test

Pairwise Comparisons of Groups	Significant value	Remark
CONTROL VS INSULIN	P=0.0001	Statistically significant
CONTROL VS OHA	P=0.0001	Statistically significant
INSULIN VS OHA	P=0.611	Statistically Insignificant

Figure 3: Box & whisker Plot with HBA1C comparing 3 groups

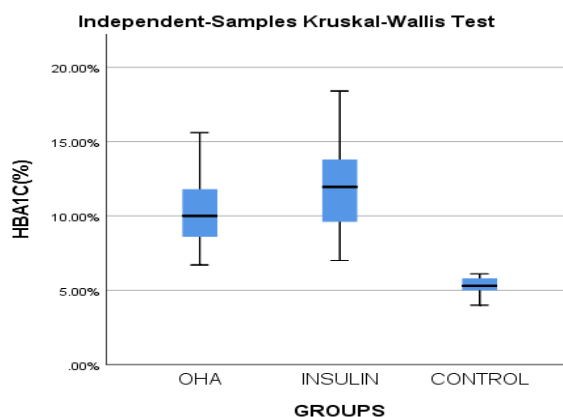


Table 5: Non-Parametric test

Descriptive Statistics								
	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
AGE(YRS)	90	51.08	17.177	19	92	40.00	50.00	62.00
HEMOGLOBIN	90	12.543	1.6887	9.1	17.5	11.575	12.550	13.700
PLATLET COUNT	90	282933.33	173933.592	100000	1649000	196000.00	273500.00	322000.00
MEAN PLATELET VOLUME	90	10.831	1.6250	6.6	15.0	9.500	10.800	12.000
HBA1C(%)	90	9.1389%	3.57877%	4.00%	18.40%	5.7250%	8.9500%	11.9250%
FBS	90	162.00	86.966	60	463	91.50	133.00	200.00
PPBS	90	219.37	103.582	100	499	120.00	200.00	300.00
GROUPS	90	2.00	.821	1	3	1.00	2.00	3.00

DISCUSSION

Diabetes mellitus is one of the most prevalent diseases in developing countries [10]. Hereditary and environmental factors play a major contributory factor in the pathophysiology of disease status. An increase in insulin resistance, decrease in insulin production, and eventual beta cell failure produce a chronic inflammatory condition in our body. Chronic hyperglycemia, the hallmark of diabetes mellitus (DM), is an intricate condition that can cause complications to the kidneys, eyes, peripheral nerves, and macro and Microvascular systems [11]. The average mean value of the OHA group, which included 30 diabetic patients was 12.260 fl, more significant than the mean value of group receiving insulin and the average healthy population. The mean MPV was 8.27 ± 0.74 fl in the study by Kodiatte et al [12]. The study participants had a mean age of 52.56 years, with 24 females and 26 males participating. In a study by Shah B et al; the presence and severity of diabetes were substantially related to mean platelet volume [13]. The group with inadequate glycemic control exhibited a greater correlation. The presence and severity of diabetes were significantly correlated with mean platelet volume in a study by Shah B et al., and the group with inadequate glycemic management showed a stronger correlation. The study participants receiving OHA had mean fasting blood sugar values of 192.23 mg/dl; INSULIN patients had mean values of 207.90 mg/dl, and control groups had mean values of 85.87 mg/dl. The average fasting blood glucose level in the Kodiatte et al. trial was 151.5 ± 71.7 mg/dl. MPV and fasting blood glucose levels showed a favourable link; these findings supported Kodiatte et al.'s investigation, producing comparable results. Long-term diabetic patients with poor glycemic control are more likely to develop micro- and macrovascular complications. Long-term diabetes patients with poor glucose control are more likely to develop microvascular and macrovascular problems. Changes to risk factors are required to avoid long-term impacts [14]. Higher platelet size may explain some of the higher atherosclerosis risk associated with diabetes and related complications. As a result, MPV may be a useful prognostic biomarker for diabetes-related cardiovascular problems. MPV shows platelet size and activity. Larger platelets produce higher levels of serotonin, β -thromboglobulin, and thromboxaneA2 compared to smaller platelets [15,16].

Limitation of study

Among the varied different kinds of OHA available, which oral hypoglycemic agent causes an increase in MPV is a key question, especially considering that most Indians use multiple combination drugs. The

significant limitation of a small population group underscores the need for a larger and more diverse diabetic group to accurately define MPV as a marker of atherothrombotic complications.

CONCLUSION

After comparing the data results, we can conclude that Mean Platelet volume is the most valuable and can act as a prognostic marker for people suffering from Type II Diabetes Mellitus, and it can predict both micro-vascular and Macro-vascular Events. Thus, we can come to conclusive evidence from the data that it can promote Atherothrombosis and thrombo embolic events, leading to Cardiovascular Ischemic events and Transient Ischemic Attacks and stroke. Hence, early start of Insulin in patients who have a family history of Type II Diabetes Mellitus and in patients who have a history of Sudden cardiac and Other CNS ischemic events will benefit from the therapy instead and can act as a prognostic marker and can stratify which patient needs oral hypoglycemic therapy or insulin therapy and can also tell which patient needs Statins therapy to decrease the risk of future .

REFERENCES

- [1] Karamanou M, Protogerou A, Tsoucalas G et al. Milestones in the history of diabetes mellitus: The main contributors. *World Journal of Diabetes* 2016 10;7(1).
- [2] Köşüş N, köşüşaydın, Turhan N. Mean platelet volume as a marker of future cardiovascular disease risk in pregnant women with impaired fasting glucose and impaired glucose tolerance. *Turkish Journal of Medical Sciences* 2012;42.
- [3] Falk E. Pathogenesis of Atherosclerosis. *Journal of the American College of Cardiology* 2006;47(8):C7-12.
- [4] Inoue H, Saito M, Kouchi K, Asahara SI, Nakamura F, Kido Y. Association between mean platelet volume in the pathogenesis of type 2 diabetes mellitus and diabetic macrovascular complications in Japanese patients. *J Diabetes Investig* 2020;11(4):938-945.
- [5] KG Chamberlain, M Tong, E Chiu, DG Penington; The relationship of human platelet density to platelet age: platelet population labeling by monoamine oxidase inhibition. *Blood* 1989; 73 (5): 1218-1225.
- [6] Hekimsoy Z, Payzin B, Ornek T, Kandoğan G. Mean platelet volume in Type 2 diabetic patients. *J Diabetes Complications* 2004;18(3):173-6.
- [7] Zuberi BF, Akhtar N, Afsar S. Comparison of mean platelet volume in patients with diabetes mellitus, impaired fasting glucose and non-diabetic subjects. *Singapore Med J* 2008;49(2):114-6.
- [8] Khandekar MM, Khurana AS, Deshmukh SD, Kakrani AL, Katdare AD, Inamdar AK. Platelet volume indices in patients with coronary artery disease and acute myocardial infarction: an Indian scenario. *J Clin Pathol* 2006;59(2):146-9.
- [9] O'Malley T, Langhorne P, Elton RA, Stewart C. Platelet size in stroke patients. *Stroke* 1995;26(6):995
- [10] Montserrat-de la Paz S, D Miguel-Albarreal A, Gonzalez-de la Rosa T, Millan-Linares MC, Rivero-Pino F. Protein-based nutritional strategies to manage the development of diabetes: evidence and challenges in human studies. *Food Funct* 2023;14(22):9962-9973.
- [11] Şahpaz F, Ulutaş K. Assessment of mean platelet volume in type 2 diabetics receiving insulin or oral antidiabetic agents. *Dicle Med J* 2016;42(4):399-403.
- [12] Kodiatte TA, Manikyam UK, Rao SB, Jagadish TM, Reddy M, Lingaiah HK, Lakshmaiah V. Mean platelet volume in Type 2 diabetes mellitus. *J Lab Physicians* 2012;4(1):5-9.
- [13] Shah B, Valdes V, Nardi MA, Hu L, Schrem E, & Berger JS. Mean platelet volume reproducibility and association with platelet activity and anti-platelet therapy. *Platelets* 2013; 25(3):188-192.
- [14] Khuwaja AK, Rafique G, White F, Azam SI. Macrovascular complications and their associated factors among persons with type 2 diabetes in Karachi, Pakistan--a multi-center study. *J Pak Med Assoc* 2004;54(2):60-6.
- [15] Colwell JA, Nesto RW. The platelet in diabetes: focus on prevention of ischemic events. *Diabetes Care* 2003;26(7):2181-8.
- [16] Chang, Hyun-Ah & Hwang, Hwan-Sik & Park, Hoon-Ki & Chun, Min-Young & Sung, Ja-Young. The Role of Mean Platelet Volume as a Predicting Factor of Asymptomatic Coronary Artery Disease. *Korean Journal of Family Medicine* 2010; 31.