

International Journal of Clinical Obstetrics and Gynaecology

ISSN (P): 2522-6614

ISSN (E): 2522-6622

© Gynaecology Journal

www.gynaecologyjournal.com

2023; 7(4): 28-33

Received: 28-04-2023

Accepted: 01-06-2023

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Platelet indices in gestational diabetes mellitus and normal pregnancies: A comparative study

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DOI: <https://doi.org/10.33545/gynae.2023.v7.i4a.1366>

Abstract

Background: A condition known as gestational diabetes mellitus occurs when there is any level of glucose intolerance that begins during pregnancy or is discovered for the first-time during pregnancy. The prime purpose of identifying women with GDM is to detect the women who are at risk of developing this condition and also to decrease perinatal morbidity and mortality. In India, GDM is considered as a significant health issue with prevalence rates 4.6% to 14% in urban areas, and 1.7% to 13.2% in rural areas. India also has an estimated number of 62 million people with type 2 diabetes mellitus. Increasing number of cases with GDM also increases risk of development of type 2 diabetes mellitus later in life.

Aim: The aim of the study was to assess the platelet indices in cases of gestational diabetes mellitus & normal healthy pregnancy and to compare the various parameters among them.

Materials and Methods: This study was conducted in R. L. Jalappa Hospital in Kolar. In the study period of January 2021 to December 2022. 138 pregnant women, 69 with gestational diabetes mellitus and 69 with normal pregnancies above 20 weeks of gestation were enrolled in to the study. Complete blood investigations were sent, and the platelet indices were compared among the two groups.

Results: This study has shown a statistical difference between two groups in respect to platelet count, PDW, MPV, PCT and P-LCR. The mean platelet count of patients with GDM was 1,39,620/mm³ whereas the platelet count of normal healthy patients was 2,66,420/mm³. The mean platelet distribution width was also higher in GDM (16.22fL) as compared to normal pregnancies (11.29fL). The Mean Platelet Volume in cases of GDM was 13.71fL, in normal pregnancy it was 9.49fL, which is significantly higher in former group.

Because of the changes in the morphology of platelet, the plateletcrit in normal pregnancy is higher (0.23%) and lower in GDM women (0.21%). The value of P-LCR is increased in women with GDM (31.17%) as compared to the women without diabetes (26.35%).

Conclusion: In this present study, we have found that low platelet count and increased MPV, PDW and P-LCR in GDM pregnant women as compared to normal pregnant women.

Keywords: Gestational diabetes mellitus, platelet indices, perinatal outcome, macroplatelets, MPV

Introduction

Pregnancy is symbolized by a hyper insulinemic state and a decrease of tissue receptors to insulin. The most common metabolic disorder during pregnancy, gestational diabetes mellitus has negative effects on both the mother and the foetus. Any level of glucose intolerance that begins or is first noticed during pregnancy is referred to as gestational diabetes mellitus (GDM). It has been estimated that 2 to 5% of pregnancies have GDM. GDM rates are projected to be 10 to 14.3% in India, one of the world's most populous nations, which is significantly higher than in the west ^[1].

Nitric oxide synthase activity is lowered and peroxynitrite generation is elevated in diabetic patients with impaired platelet function ^[2]. Higher platelet synthesis is clearly indicated by increased platelet volumes ^[2]. There is a slight increase in platelet aggregation during normal pregnancies. Increased platelet synthesis counteracts this rise, increasing mean platelet volume (MPV) as a result ^[3].

Pregnant women in good health have a marked rise in NOS activity in their platelets, which may be connected to the lower percentage of activated platelets and lower aggregation. However, the lower activity reported in the platelets of people with Type 1 and Type 2 diabetes does not match the higher NOS activity shown in GDM ^[4].

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Patients with diabetes mellitus have been documented to have altered platelet shape and function [5]. Increased risk of vascular disease and venous thromboembolism may be linked to these alterations.

This study was conducted to measure the various parameters of platelets and to compare them in between pregnant women with GDM and normal healthy pregnancies.

Objectives

1. To assess the platelet indices in a normal pregnancy
2. To assess the platelet indices in gestational diabetes mellitus
3. To compare the platelet indices in gestational diabetes mellitus and normal pregnancies

Methods

The study is a comparative study which was conducted in R. L. Jalappa Hospital, Kolar from January 2021 to December 2022. 138 pregnant women, 69 with gestational diabetes mellitus and 69 with normal pregnancies above 20 weeks of gestation were enrolled in to the study. Written informed consents were taken from all the patients prior to enrollment of study. Institutional Ethical Committee permission and approval obtained. 2ml peripheral venous blood sample was collected from all the subjects in ethylene diamine tetra acetate (EDTA) coated vacutainer and analyzed using automated 5 part cell counter Sysmex (XT 1800i) to measure complete blood count (CBC) and platelet parameters such as platelet count (PLT), plateletcrit (PCT), MPV, PDW, and platelet-large cell ratio (P-LCR). Slides were also stained by Leishman stain according to standard operative protocol and manual microscopic examination of peripheral smears was done for confirmation of the parameter. Study Group (Group A v/s Group B) was considered as

explanatory variable. All Quantitative variables were checked for normal distribution within each category of explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro-wilk test was also conducted to assess normal distribution. Shapiro wilk test p value of >0.05 was considered as normal distribution.

Data was also represented using bar chart, error bar chart and clustered bar chart. For normally distributed Quantitative parameters the mean values were compared between study groups using Independent sample t-test (2 groups).

Categorical outcomes were compared between study groups using Chi square test. P value < 0.05 was considered significant statistically. IBM SPSS version 22 was used for statistical analysis.

Results

The study was conducted in a tertiary care center in Kolar. It included 69 patients with GDM beyond 20 weeks of gestation and 69 patients with normal pregnancies.

In this study, the highest number of cases in the GDM group belongs to the age group of 26-30 years, corresponding to 46.4% of the total cases. The highest number of cases in the normal group belongs to 21-25 years, coming up-to 42% of all the cases. In the present study, around 73.9% of the GDM population was term, with the gestational age between 36⁺ weeks to 40 weeks. In the normal group also 72.5% of the study population were of term gestation.

The highest number of cases in GDM group in this study belonged to gravida 2, accounting for up-to 37.7%, whereas the highest number cases in the normal group were primigravida, coming up-to 46.4%.

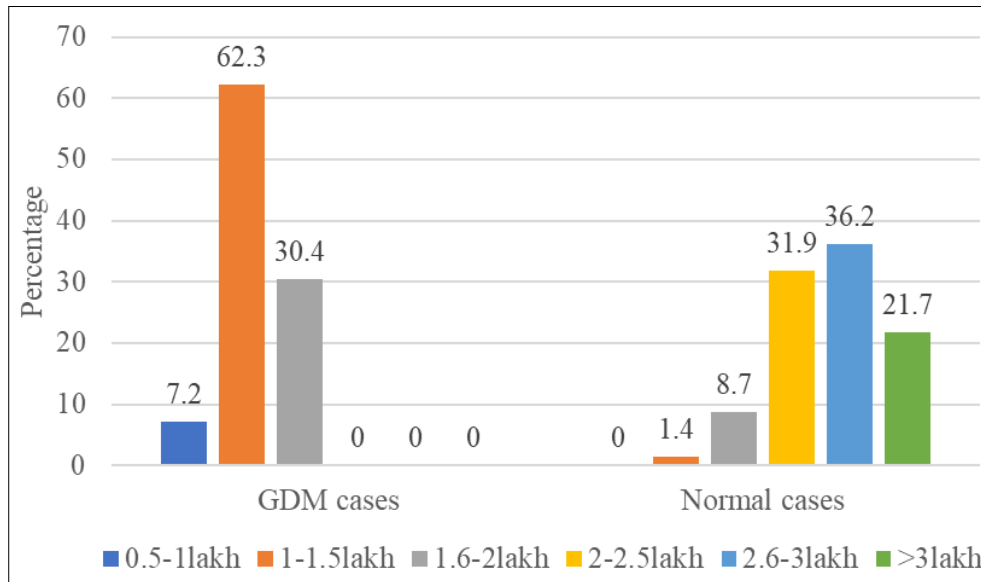


Fig 1: Graph showing Distribution of subjects according to platelet count among two groups

Table 1: Comparison of mean platelets count among GDM cases group and Normal cases groups

Group	Mean platelets count/mm ³	SD	P Value
GDM cases	1,39,620	35,078	<0.001
Normal cases	2,66,420	54,641	

In the present study, GDM group had platelet value of 1-1.5 lakh mm³ as the highest, coming up-to 62.3%, followed by 1.6-2 lakh mm³, 30.4% of the cases. In the normal group, maximum patient had platelet of 2.6-3 lakh mm³ coming up-to 36.2%, followed by

2-2.5 lakh mm³, that is 31.9%. It is observed that the cases with GDM has a lower platelet count compared to normal cases.

P value <0.001, there was a statistically significant difference found between GDM cases group and Normal Cases group with respect to platelet count.

The mean value of platelet in GDM group is 1,39,620 and that of normal group is 2,66,420. There was a statistically significant difference found between GDM cases group and Normal Cases group with respect to mean platelet count.

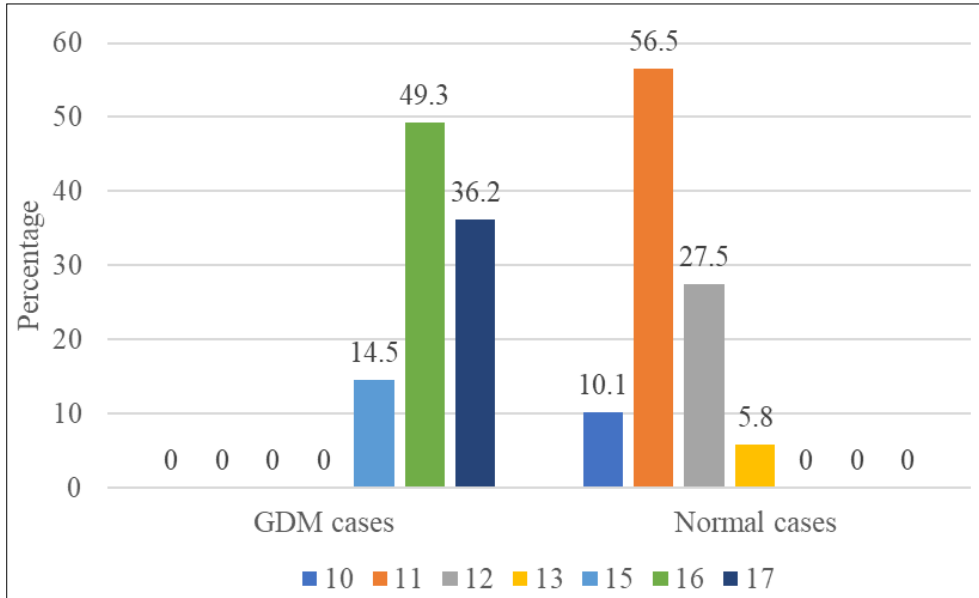


Fig 2: Graph showing Distribution of subjects according to Platelet Distribution Width among two groups

Among the GDM cases, 49.3% had the value of PDW as 16 fL, which was the highest. Then 17fL, was the second highest, being 36.2%. In the normal group 56.5% had Platelet Distribution Width of 11fL, and 27.5% had 12 fL. It is observed that the Platelet Distribution Width among the GDM group is higher than normal group.

P value <0.001, there was a statistically significant difference found between GDM cases group and Normal Cases group with

respect to PDW. The mean PDW in GDM cases was 16.22 compared to the normal cases, which was 11.29. It is therefore seen that the Platelet Distribution Width among women having GDM is higher than in women without GDM.

There was a statistically significant difference found between GDM cases group and Normal Cases group with respect to mean PDW.

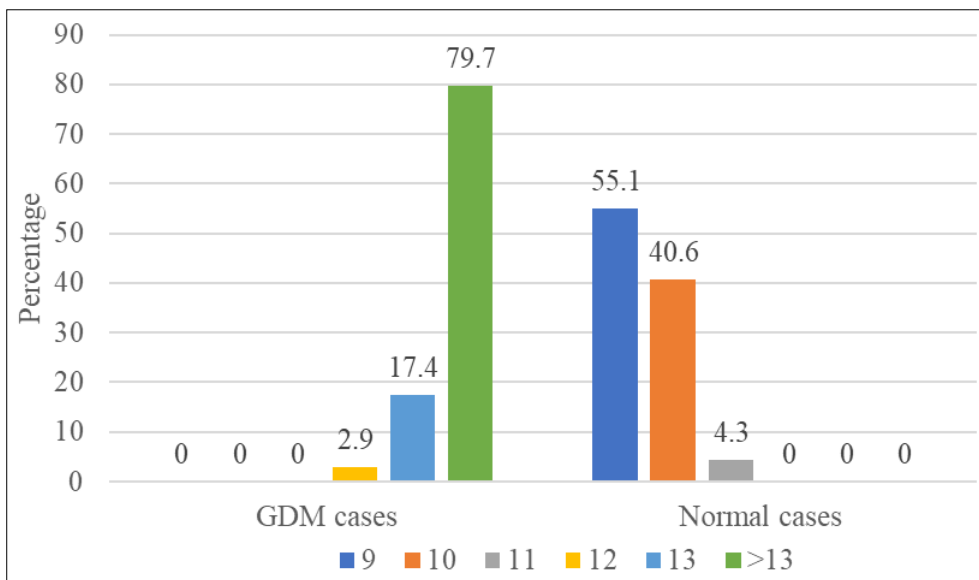


Fig 3: Graph showing Distribution of subjects according to Mean Platelet Volume among two groups

Table 2: Comparison of mean of Mean Platelet Volume among GDM cases groups and Normal cases groups

Group	Mean MPV (fL)	SD	P Value
GDM cases	13.71	1.373	<0.001
Normal cases	9.49	0.585	

The MPV was >13fL in 79.7% of the women with GDM in this study population. Whereas in normal cases 55.1% of cases had a Mean Platelet Volume of 9 fL, which was the highest in that

population. From this study it is seen that the women having GDM had a higher mean platelet volume (MPV) as compared to women without GDM.

P value <0.001, there was a statistically significant difference found between GDM cases group and Normal Cases group with respect to Mean Platelet Volume

The mean value of Mean Platelet Volume in GDM group is 13.71 whereas the mean MPV in patients without GDM is 9.49.

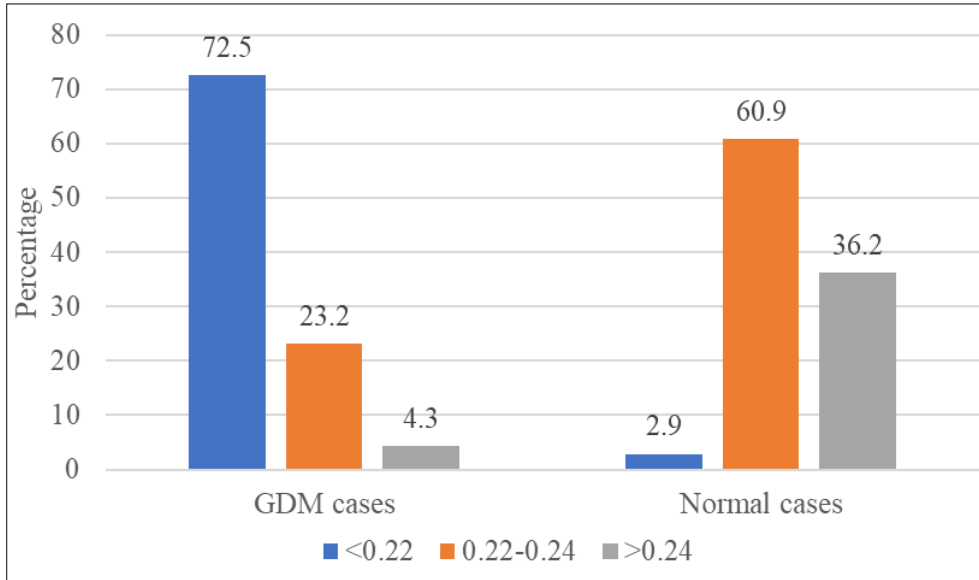


Fig 4: Graph showing Distribution of subjects according to Plateletcrit among two groups

Plateletcrit (PCT) among the GDM group was <0.22% in majority of the cases, that is 72.5% due to the smaller size and the lesser platelet count. But, in normal cases, 0.22-0.24% was the highest, coming up to 60.9%. Around 36.2% of cases that PCT >0.24%. P value <0.001, there was a statistically significant difference

found between GDM cases group and Normal Cases group with respect to PCT. There was a statistically significant difference found between GDM cases group and Normal Cases group with respect to mean PCT.

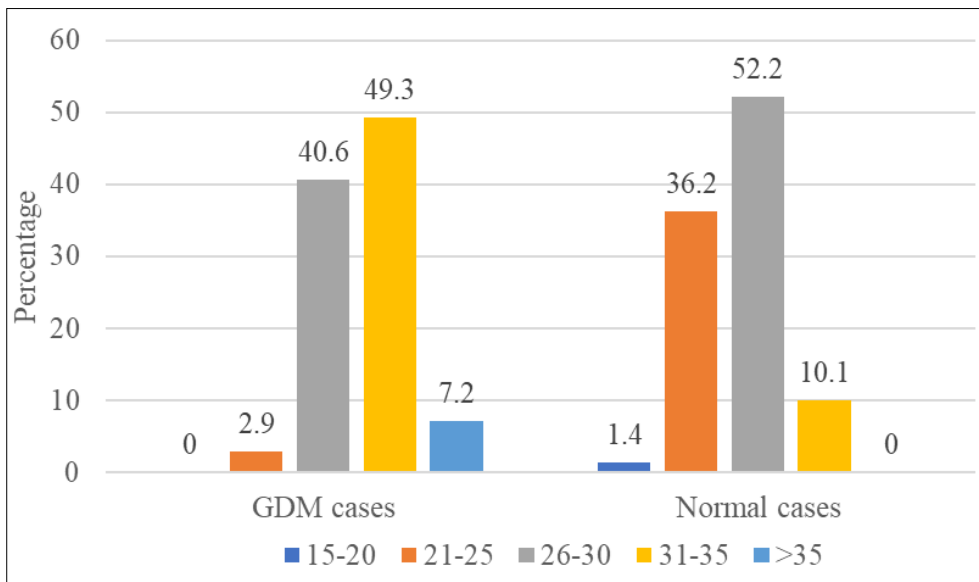


Fig 5: Graph showing Distribution of subjects according to P-LCR among two groups

In this study, 49.3% of patient with GDM had a Platelet Large Cell Ratio (P-LCR) of 31-35 which was the majority, whereas patients without GDM had 31-35 as the highest value, in 52.2% of the cases. P value <0.001, there was a statistically significant difference found between GDM cases group and Normal Cases group with respect to P-LCR. The mean value of P-LCR among GDM group is 31.17% and that of normal cases is 26.35%. There was a statistically significant difference found between GDM cases group and Normal Cases group with respect to mean P-LCR. Among the GDM cases, 82.6% of patients underwent LSCS and 17.4% had vaginal delivery. Whereas, among the normal group,

55.1% had LSCS and 44.9% of the patients had vaginal delivery. In the study conducted, the babies delivered by GDM mothers were all admitted to NICU in view of infant care of diabetic mother, whereas only 8.7% of babies borne to normal mothers were admitted to NICU.

Discussion

One of the most common pregnancy obstacle is gestational diabetes mellitus (GDM), which is described as variable degrees of decreased glucose tolerance that are first noticed during pregnancy [6]. The average size and activity of platelets are shown by the mean platelet volume (MPV). Increased MPV levels are thought to be a new independent cardiovascular risk factor and are linked to larger and more active platelets [7].

A systemic condition, gestational diabetes affects both the mother and the fetus.

In the present study, there is a significant difference between GDM cases group and Normal Cases group in relation to age group. In this study, the highest number of cases in the GDM group belongs to the age group of 26 to 30 years. The highest number of cases in the normal group belongs to 21 to 25 years. Present study is in accordance with the study conducted by Eser Colak *et al.*, 2019, according to the ages, control group had two hundred patients with a mean age of 29.00 ± 7.5 whereas the study group included two hundred patients with an average age of 34.00 ± 6.0 ($p < 0.001$)^[8]. This study is not in accordance with the Kebapcilar L *et al.* study from 2016, in which maternal age was not significantly different between the groups. The mean maternal ages of the controls and cases were, respectively, 26.51 ± 5.14 and 26.12 ± 5.05 years^[9].

In the present study, there was no statistical significant difference that was found between GDM cases group and Normal Cases group with respect to gestational age (P value 0.118). Around 73.9% of the GDM population was term, with the gestational age between 36⁺ weeks to 40 weeks. In the normal group also 72.5% of the study population were of term gestation. This study is in accordance with the study conducted by Bushra Jabbar Hamarashid which showed the majority of the samples (54.0%) of the total participants in the GDM group were between 20 and 29 weeks pregnant. According to data, 56.2% of participants in non-GDM were between 20 and 29 weeks pregnant^[10].

In the current study, the mean platelet value for the GDM group was 1,39,620, while it was 2,66,420 for the normal group. There is a statistical significant difference found between GDM cases group and Normal Cases group with respect to mean platelet count. Result of the study was in accordance study conducted by Javid Ahmed Khan in 2022 which shows that the mean platelet count was on the lower side $170 \times 03 / \mu\text{L}$ in GDM group as compared to control group (193.48 ± 89.4)^[11]. The result of the study is not in accordance with conducted by Muhammet Erdal Sak study which shows that the mean platelet count was 250.4 ± 64.4 in GDM group and 256.8 ± 63.8 in control group. There was no significant difference found between GDM cases group and Normal Cases group^[12].

The mean PDW in GDM cases was 16.22 compared to the normal cases, which was 11.29. It is therefore seen that the Platelet Distribution Width among women having GDM is higher than in women without GDM. There is a statistical significant difference seen between GDM cases group and Normal Cases group with respect to mean PDW. Similar to the present study, in a study by Erdoğan S *et al.*, in 2014, mean values for platelet distribution width (PDW) was higher in the GDM group (16.19 ± 2.42) compared to healthy controls (14.56 ± 2.80). Present study is not in accordance with the study by Sak *et al.*, in which mean values for platelet distribution width (PDW) was 18.2 ± 1.2 fL in GDM group as compared to healthy controls (18.1 ± 1.4). There was no significant difference seen between GDM cases group and Normal Cases group with respect to mean PDW^[13].

The mean value of Mean Platelet Volume in GDM group is 13.71 whereas the mean MPV in patients without GDM is 9.49. There is a statistical significant difference found between GDM cases group and Normal Cases group with respect to mean MPV. According to Baldane S *et al.*, in 2015, in the group with GDM, MPV value was found to be more [10.2 (8.0-12.2)] than that of the control group [9.9 (5.81-10.9)] (P = 0.004)^[14]. It has been shown that MPV was increased in GDM patients when

compared to healthy pregnancies. Ozlem Turhan Iyidir *et al.*, in 2014, observed a difference for MPV values bet the GDM 8.8 ± 1.0 and normal group 8.1 ± 0.7 . It has been further concluded that the presence of a high MPV in GDM could demonstrate an increase in risk for current and future thrombotic complications.

In a study by Kebapcilar L *et al.*, in 2016. The relationship between MPVs and IR and neonatal APGAR scores in individuals with GDM has been studied. By evaluating APGAR score in women with GDM, higher MPV value appears to be able to identify poor foetal outcome. MPV levels can be used in antenatal monitoring of foetal welfare and may be a good predictor of foetal outcome^[15].

Conclusion

In this present study, we have found that low platelet count and increased MPV, PDW and P-LCR in GDM pregnant women as compared to normal pregnant women.

Decreased platelet count and increased MPV can be used as an early predictor of GDM. These changes in the platelet indices may put the diabetic pregnant women at a higher risk of development of vascular complications. However further studies are required in this field.

Conflict of Interest

Not available

Financial Support

Not available

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How to Cite This Article

Borthakur P. Platelet indices in gestational diabetes mellitus and normal pregnancies: A comparative study. *International Journal of Clinical Obstetrics and Gynaecology*. 2023;7(4):28-33.

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