"PLATELET INDICES IN GESTATIONAL DIABETES MELLITUS AND NORMAL PREGNANCIES – A COMPARATIVE STUDY"

By

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MASTER OF SURGERY

IN

OBSTETRICS AND GYNAECOLOGY

Under the Guidance of

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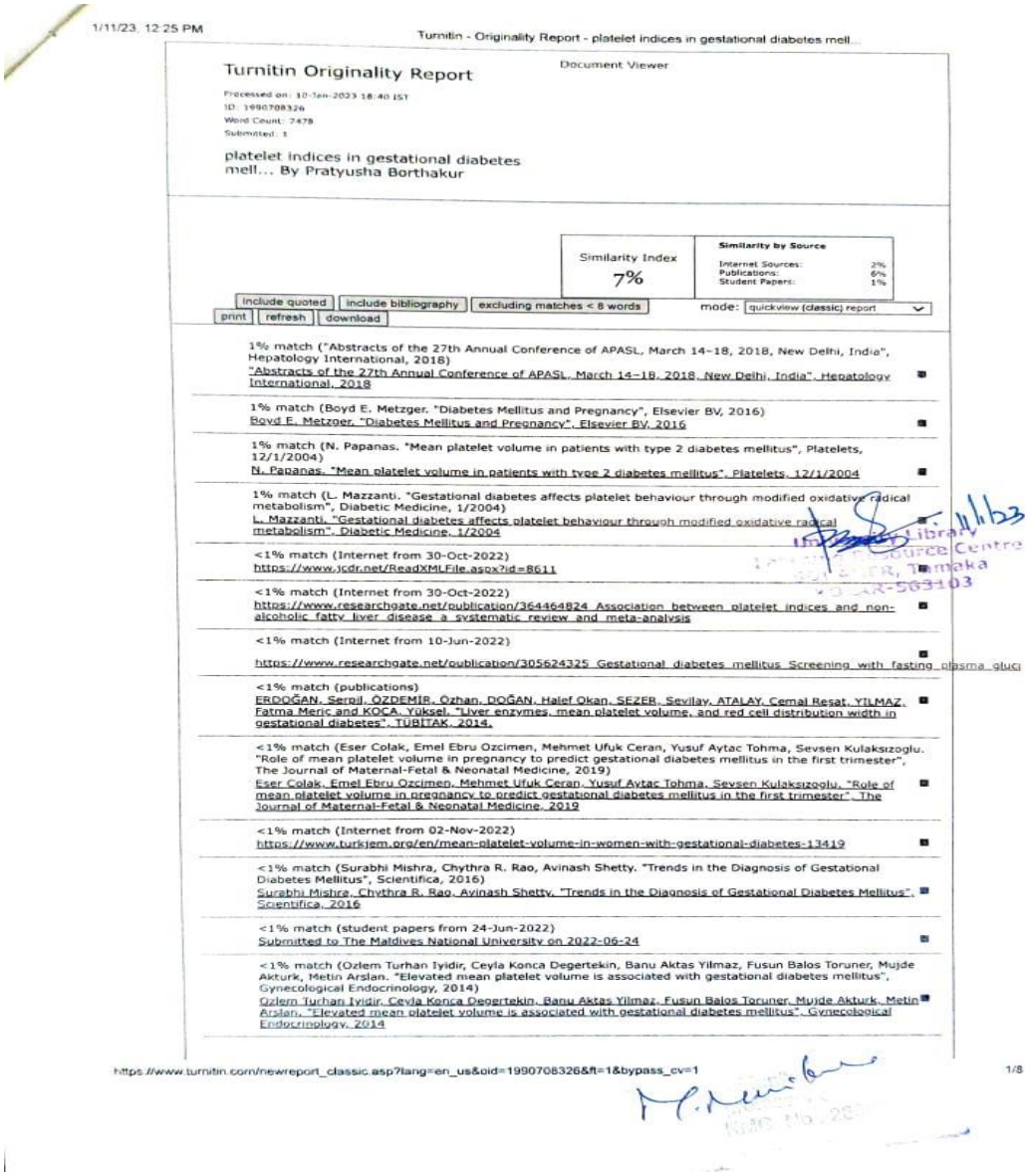

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Dr. PRATYUSHA BORTHAKUR

LIST OF ABBREVIATIONS

DM	Diabetes Mellitus
PE	Pre Eclampsia
GDM	Gestational Diabetes Mellitus
MPV	Mean Platelet Volume
PDW	Platelet Distribution Width
P-LCR	Platelet Large Cell Ratio
PCT	Plateletcrit
IR	Insulin Resistance
NO	Nitric Oxide
NOS	Nitric Oxide Synthase
TBARS	Thiobarbituric Acid
OGTT	Oral Glucose Tolerance Test
TNF	Tumor Necrosis Factor
hCS	Human Chorionic Somatotrophs
hPL	Human Placental Lactogen
hGH-V	Human Placental Growth Hormone Varient
CRF	Corticotrophin Releasing Factor
IRS-1	Insulin Receptor Substance-1
FPG	Fasting Plasma Glucose
FFA	Free Fatty Acid
ADA	American Diabetic Association
IADPSG	International Association of Diabetes and Pregnant Study Group

WHO	World Health Organisation
NDDP	National Diabetic Data Group
USPS TF	United States Preventive Services Task Force
GCT	Glucose Challenge Test
HOM A-IR	Homeostasis Model Assessment Insulin Resistance Index
GRBS	Random Blood Glucose
WBC	White Blood Cell
PIH	Pregnancy Induced Hyprtension
SD	Standard Deviation
WBC	White Blood Cells
PC	Platelet Count

CONTENTS

LIST OF TABLES

LIST OF FIGURES

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/mm^3 whereas the platelet count of normal healthy patients was 2,66,420/mm^3. 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 is 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.

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AIMS AND 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

MATERIALS AND METHODS:

Study site: The current study is conducted in the department of Obstetrics and gynaecology at R. L. Jalappa Hospital, Kolar. Study population: All the pregnant women with normal healthy pregnancy and with gestational diabetes mellitus patients delivered at RLJH hospital were considered as study population.

Study design: The current study was a comparative studySample size:

There are 2 groups considered,
Group A –69 normal pregnant women.

Group B- 69 pregnancy with gestational diabetes mellitus including overt diabetes mellitus

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). A physiological insulin resistance that starts in the second trimester and peaks in the third trimester, which results in increased insulin secretion, characterises a typical pregnancy. Increased insulin production, which cannot offset the rise in insulin resistance, leads to 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].

The prenatal care of women with gestational diabetes mellitus (GDM) focuses on recognising and addressing problems that are more prevalent among women with glucose impairment, in addition to regular pregnancy difficulties. Due to the brief duration of the condition and its late pregnancy onset, women with true GDM often do not experience diabetes related vasculopathy or an increased risk of having babies with congenital abnormalities.

Many studies now focus on predicting GDM in the early stages of pregnancy. In order to assess insulin resistance (IR) in the first trimester of pregnancy, a number of approaches have been documented in the literature. According to several research, platelets may be involved in the aetiology of gestational diabetes. In the study of Bozkurt et al., it was proposed that it may be related to platelets[2].

Patients with diabetes mellitus have been documented to have altered platelet shape and function[3]. Increased risk of vascular disease and venous thromboembolism may be linked to these alterations. Although primary hemostasis and coagulation may be activated in a healthy pregnancy, there is little research on these problems in gestational diabetes. In the second trimester of pregnancy, women with GDM had considerably greater platelet and MPV levels than healthy pregnant women, according to research by Gorar et al., Sahbaz et al., and eltik et al[3].

Nitric oxide synthase activity is lowered and peroxynitrite generation is elevated in diabetic patients with impaired platelet function[4]. Higher platelet synthesis is clearly indicated by increased platelet volumes[4]. 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[5]. A marker of platelet function and activation is platelet volume. Clinical haematology analyzers can measure it as mean platelet volume (MPV). Changes in platelet volumes during a healthy pregnancy may be a more accurate indicator of a change in platelet function than changes in platelet numbers[6]. Additionally, it is elevated in pre-eclampsia, acute ischemic stroke, acute myocardial infarction, and renal artery stenosis[7]. The development of pre-eclampsia, restenosis after coronary angioplasty, and a poor outcome following myocardial infarction are all predicted by a higher MPV, which is significant[8].

It has been suggested that diabetic individuals' hyperglycemia may trigger the development of bigger platelets. Larger platelets produce more thromboglobulin, serotonin, and thromboxane A2 because they contain denser granules and release more of these chemicals[9]. Additionally, it has been hypothesised that in these patients, the elevated platelet activity intensifies vascular problems.

The human uterine artery's NO (nitric oxide)-dependent relaxation reactions to acetylcholine are increased during pregnancy. This functional characteristic is compatible with the lower systemic vascular resistance seen during pregnancy and is linked to an up-regulation of endothelial NOS protein expression with increased Ca2+ dependent NOS (nitric oxide synthase) activity. 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. Compared to HPW (gene), GDM platelets had a higher basal concentration of peroxynitrite, which may be the result of a different balance between NO and the superoxide anion generated by the cells. This balance between NO and superoxide anion may have been altered by both the increased NOS activity and the oxidative stress seen by the increased TBARS and hydroperoxide content of platelet membranes from GDM women. Comparing GDM women to healthy pregnant women, there is a change in the generation of platelet NO and peroxynitrite as well as an increase in platelet signs of oxidative stress[10].

The GDM test is typically adviced today between 24 and 28 weeks of gestation. A standard OGTT must be performed using a 75 gram glucose test in one phase or a 50 gram glucose screening followed by a 100 gram glucose screening in two steps. In order to manage gestational diabetes in pregnant women and save the foetus from the harmful consequences of hyperglycemia, either 75 g or 100 g tests are sometimes difficult for pregnant women to tolerate. Diagnosing GDM after 24 weeks of gestation may sometimes become late. Therefore, research into MPV levels in GDM is based on findings that DM patients have enhanced platelet activity[11].

The pathophysiologic cause of the elevated MPV seen in GDM is still not fully

understood. However, a number of reasonable theories could account for their connection. Insulin resistance may play a significant role in determining platelet activation, which can be assessed by MPV. Therefore, more studies must be conducted in order to assess the Power of MPV value to predict GDM.

NEED OF THE STUDY

Diabetes mellitus is a complex disease in which altered platelet morphology and functions have been reported. Mean platelet volume is a marker of platelet function and activation. Larger platelets are more reactive and aggregable and in this state there is increased production of thromboxane A2 and decreased production of prostacyclin which results in vasoconstriction. This effect is considered responsible for both the micro and macrovascular complications of diabetes mellitus.

Gestational diabetes mellitus is defined as any degree of glucose intolerance with its onset or first recognition during pregnancy. Indian population comes under a high risk ethnic group for acquiring the disease. Gestational diabetes mellitus is associated with risk for the mother as well as the fetus.

Studies have shown an increase in mean platelet volume in patients of gestational diabetes mellitus which is associated with many vascular complications which aggravate the microangiopathic complications associated with diabetes.

Our hospital has a yearly admission rate of twelve thousand including outpatient and inpatient, out of which nearly around 300 are diagnosed with gestational diabetes mellitus, which constitute about 3 to10% of all the pregnancies. Since our hospital is a tertiary care hospital in a remote area, a lot of cases get referred from the nearby districts and states.

This makes it necessary for such a study to take place, to compare the platelet indices in the women with gestational diabetes and in non diabetic women.

AIMS AND 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

REVIEW OF LITERATURE

Pregnancy is a diabetogenic physiologic event. Women with diabetes often need more insulin during late pregnancy. Overt diabetes may develop in women with previously undetected glucose intolerance. In others, a transitory asymptomatic impairment in gluco-regulation may be unmasked. These diabetogenic elements of pregnancy are linked to difficulties in both the mother and the foetus, as well as potential long-term effects. Since the problems with the foetus don't arise when the patient's father is the only parent that has diabetes, they don't appear be linked to genetic components of the condition. Instead, they are connected to changes in the maternal environment that the foetus is exposed to. Discussion is held regarding the implications for pregnancies in which diabetes mellitus (DM) either predates pregnancy (preexisting DM) or develops during the current pregnancy (gestational DM [GDM]).

History

Before insulin was discovered, pregnancy in woman with DM was merely a medical curiosity. The few DM patients who made it through adolescence were frequently sterile. In view of the dangerously high rates of both maternal (25%) and perinatal death (40% to 50%) during the period, those who were pregnant regularly sought therapeutic abortion. Diabetic women typically reached adulthood with minor reproductive damage after therapy with insulin became available. Maternal mortality decreased to a level that was comparable to women who did not have DM. Not until much later did foetal wastage experience a comparable decline.

The percentage of foetal loss was lowered to 10% to 15% in the 1950s and 1960s

because to innovative initiatives built on the theory that maternal diabetes management is linked to foetal survival.

A growing number of women who have had type 1 DM for a long period are becoming pregnant in recent years, sometimes despite vascular and/or neuropathic difficulties. Preexisting type 2 diabetes compromising pregnancy has become more common during the past 20 years. Congenital deformity and unfavourable pregnancy outcomes are frequently as common in type 1 DM complicated pregnancies[12].

PATHOGENESIS

Metabolic Effects of Pregnancy

Although pregnancy causes significant metabolic changes, these changes do not happen consistently during the whole gestation. Instead, a chronological progression of the conceptus's development and rising insulin resistance and other metabolic alterations is observed.

The severe insulin resistance rapidly disappears in the early postpartum period. These metabolic changes are thought to be caused by the conceptus based on their temporal relationships.

“Repeated measures of insulin sensitivity before and during pregnancy demonstrate a moderate drop by 12 to 14 weeks and further decline by end of second trimester in a relatively small number of women with normal carbohydrate metabolism[13]. Insulin sensitivity decreases by 40% to 60% in the third trimester compared to non-gravid women[14]. When compared to the level of insulin resistance they had prior to becoming pregnant, women with GDM showed a moderate improvement in insulin sensitivity at 12 to 14 weeks, according to Catalano and colleagues[13]. Following this small improvement, late in the

pregnancy, there was a transition to severe insulin resistance that was on par with or even worse than in participants with normal glucose tolerance. If a woman has type 1 diabetes and her metabolism is in check prior to becoming pregnant, she could even need to cut her insulin dosage during the first trimester owing to hypoglycemia toward the end of the first and the start of the second trimester[15]. (Figure 1).

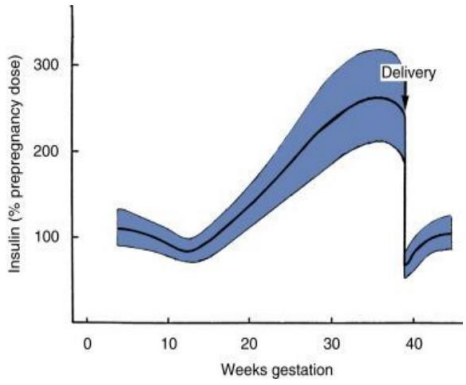


Figure -1: Schematic representation of changing insulin requirements over the course of pregnancy and after delivery in pregestational diabetes mellitus. (Phelps RL, Metzger BE, Freinkel N: Medical management of diabetes in pregnancy. In Sciarra J (ed.): Gynecology and obstetrics, vol 3. Philadelphia: Harper & Row; 1988: 1-16.)

There is very minimum to no increase in insulin release in early nondiabetic pregnancies in response to glucose. In contrast, insulin release in response to oral or intravenous glucose is 1.5 to 2.5 times larger during the third trimester of pregnancy than it is under nongravid settings[16], and islet cell hyperplasia is present. The placenta is not a barrier for insulin. In normal pregnancy and GDM, the human placenta actively degrades insulin and somewhat enhances insulin clearance despite being tiny relative to total maternal mass[14,17]. These alterations take place chronologically concurrently with the placenta's expanding size and the fetus's growth.

However, it is not totally known which specific mediators cause both insulin resistance and increased insulin production.

In previous years, other substances obtained from the placenta and/or adipose tissue have been recognized to possibly contribute to insulin resistance in healthy pregnancy and GDM (Table 1). Adiponectin levels have dropped and tumour necrosis factor (TNF) has increased[18,19.] In a healthy pregnancy or with GDM, a number of additional factors that may contribute to insulin resistance have not been well examined.

Table no1:Factors of Placental Origin that may Influence Maternal Insulin Sensitivity

Estrogens and progesterone
Human chorionic somatomammotropin (hCS) or placental lactogen (HPL)
Prolactin
Placental growth hormone variant (hGH-V)
Corticotropin-releasing factor (CRF) and corticotropin
Leptin
Tumor necrosis factor α (TNF-α)
Adiponectin
Resistin
Ghrelin
Interleukin 6 (IL-6)

Friedman and colleagues came to the conclusion that the insulin resistance of normal pregnancy is multifactorial at the molecular level and involves decreased insulin's capacity to phosphorylate insulin receptor, decreased insulin receptor substrate-1 (IRS-1) expression, and elevated levels of particular kinase[20]. Further modifications occur in GDM that prevent signaling significantly lowers GLUT4 translocations. Overall, these hormonal and metabolic alterations work to

counteract the effects of insulin at peripheral (muscle and adipose tissue) and hepatic locations.

CIRCULATIONG CONCENTRATIONS OF NUTRIENT FUELS

In Normal Pregnancy

Pregnancy lowers the fasting plasma glucose (FPG) concentration in healthy women. Early in pregnancy,[21] far before the fetus's rate of glucose uptake is high enough to affect overall maternal glucose turnover, the FPG (10 to 12 hour fast) declines most dramatically. According to reports, pregnant women who are obese do not exhibit a decrease in fasting plasma blood glucose levels. During late gestation, a less fasting plasma glucose persists despite noticeably higher post meal glucose levels. While glycemic excursions vary within small range in healthy participants, even throughout late gestation, investigations of the evening glucose profile of ambulatory pregnant women accuired by capillary blood glucose monitoring or continuous monitoring of subcutaneous-fluid show the opposite[22,23]. Prior to late gestation, when considerable rises in plasma glycerol and FFA levels occur, the transition to the metabolic profile typical of the fasting state is expedited along with increasing lipolysis and insulin resistance[24]. All significant lipid components, such as triglycerides, cholesterol, and phospholipids, experience progressive increases. Throughout gestation, total plasma amino acid concentrations continue to drop as well. Maternal hypoaminoacidemia in late pregnancy may be maintained primarily by increased foetal elimination as opposed to decreased maternal amino acids released from maternal muscle.

In Gestational Diabetes Mellitus:

The severity of the GDM is mirrored by the size of the abnormalities, and basal postprandial levels of glucose, FFAs, triglycerides and amino acids frequently exceed those of healthy control subjects[25] and frequently continue to rise even after nutritional correction. Branched chain amino acids are the most frequently disrupted and are insulin sensitive, frequently altered in obesity and other insulin resistant conditions. Recent metabolomic studies that also shed light on the implicated metabolic pathways have validated these tendencies[26]. Similar to women with normal glucose homeostasis, those with GDM are predisposed to "accelerated starvation", which is defined as a faster drop in circulating glucose concentration and a faster rise in FFAs and ketones[27]. Continuous monitoring of subcutaneous fluid revealed larger glycemic excursions and a delay in attaining postprandial peak values in ambulatory women with diet treated GDM than in healthy controls.

CLASSIFICATIONS

The American Diabetes Association (ADA) divides diabetes into four categories that are mutually exclusive. Type 1 diabetes, type 2 diabetes, and other types of preexisting diabetes make up the first three, and gestational diabetes makes up the fourth. With modification for pregnancy, this classification scheme is shown in Table 2.

TABLE NO 2 - CLASSIFICATION OF DIABETES IN PREGNANCY

A. Type 1 Diabetes: Diabetes resulting from beta cell destruction, usually leading to absolute insulin deficiency. 1. Without vascular or neuropathic complications 2. With complications
B. Type 2 Diabetes: Diabetes resulting from progressively decreased insulin secretion in the face of increased insulin resistance. 1. Without vascular or neuropathic complications 2. With complications
C. Other Types of Diabetes: Monogenic diabetes, diabetes associated with pancreatic disease drug or chemically induced diabetes and so forth.
D. Gestational Diabetes: Diabetes diagnosed during pregnancy that is not clearly overt diabetes.

Classification

Pregnant women with either gestational or preexisting diabetes are categorized according to the White classification[14,16]:

Class A1: diabetes diagnosed during pregnancy and controlled by diet.

Class A2: diabetes diagnosed during pregnancy and requiring medication.

Class B: insulin-requiring diabetes diagnosed before pregnancy when patient is older than 20 years, which lasts fewer than 10 years.

Class C: insulin-requiring diabetes diagnosed before pregnancy when patient is aged 10 to 19 years, which lasts 10 to 19 years.

Class D: diabetes diagnosed with 1 of the following criteria: patient is older than 10 years, diabetes lasts more than 20 years, or diabetes is associated with hypertension or background retinopathy.

Class F: diabetes with renal disease.

Class H: diabetes with coronary artery disease.

Class R: diabetes with proliferative retinopathy.

Class T: diabetes with renal transplant.

It is acknowledged that some women with preexisting diabetes would be included if all pregnancies with the first identification or diagnosis of hyperglycemia during pregnancy were classified as GDM. The IADPSG Consensus Panel provided guidelines for the detection and diagnosis of previous diabetes because the treatment for Type 2 DM and GDM vary in pregnancy, postpartum, perinatal, and long term risks. The IADPSG Consensus Panel also proposed improved criteria for GDM[28].

DIAGNOSIS OF GESTATIONAL DIABETES MELLITUS

"GDM diagnosis standards were first put forth 50 years ago. About 35 years ago, the "World Health Organization" (WHO)[30] and the "National Diabetes Data Group" (NDDG)[29] issued recommendations for the diagnosis of GDM. Nearly 30 years ago, the "American Diabetes Association and the American College of Obstetricians and Gynecologists"[31] both suggested methods for the early identification and diagnosis of GDM. The worth of this effort has been debated over the course of the last fifty years, though. One point of contention is the independent relationship between "diabetic fetopathy-like" outcomes in GDM with maternal increased glucose rather than phenotypic characteristics (e.g., obesity, increased maternal age, chronic HTN) with lack of proper evidence. The absence of randomised controlled trials demonstrating the efficacy of treating moderate GDM has been the second problem. The "United States Preventive Services Task Force" (USPSTF), which was established in 2008, came to the conclusion that "current evidence is insufficient to assess the balance of benefits and harms of screening for gestational diabetes mellitus, either before or after 24 weeks' gestation," according to their report.

RECOMMENDATIONS OF NATIONAL AND INTERNATIONAL ORGANIZATIONS

The optimum strategy for diagnosis of gestational diabetes mellitus to improve maternal and infant health is unclear[32]. Many organizations have published recommendations for screening and diagnosis of diabetes in pregnancy, including:

1. American College of Obstetricians and Gynecologists (ACOG, two-step approach

2. International Association of Diabetes and Pregnancy Study Groups (IADPSG, one-step approach)

3. American Diabetes Association (ADA, one-step or two-step approach)

4. World Health Organization (WHO, one-step approach

5. Canadian Diabetes Association (CDA, two-step [preferred] or one-step approach)

6. The Endocrine Society (one-step approach)

7. Australasian Diabetes in Pregnancy Society (WHO approach)

8. National Institute for Health and Care Excellence (NICE, United Kingdom)

9. International Federation of Gynecology and Obstetrics (FIGO), IADPSG (one-step approach, with possible variation in economically challenged regions).

"The lack of clear proof that "diabetic-fetopathy-like" outcomes in GDM are independently linked to maternal glycemia rather than phenotypic features has been one source of dispute (e.g., maternal obesity, increased maternal age, chronic HTN). The other issue is the deficiency of randomised controlled rials proving the effectiveness of treating moderate GDM. According to its report, the 2008 founded "United States Preventive Services Task Force"(USPSTF) reached the opinion that current evidence is insufficient to determine the balance of benefits and hazards of

screening for GDM, either before or after 24 weeks of gestation. The majority of glucose tests used today are enzymatic (glucose oxidase or hexokinase). Using numbers acquired from a 100g OGTT, Carpenter and Coustan[33] were able to more precisely extend the O'Sullivan results to glucose oxidase-based techniques. The number of women with diagnosis of GDM and lower plasma glucose values for the identification of GDM than those recommended by NDDG increases by 50% as a result of this. When one or more plasma glucose readings meet or go beyond the above mentioned values throughout the first 24 to the last 28 weeks of pregnancy, gestational diabetes is diagnosed (Table 3).

Table 3: Screening for Gestational Diabetes (GDM)

Pregnant women with risk factors	Test for undiagnosed type 2 at first prenatal visit using standard diagnostic criteria
Pregnant women without known prior diabetes	Test for GDM at 24-28 weeks
Women with GDM	Screen for persistent diabetes 6-12 weeks postpartum using OGTT and standard diagnostic criteria
Women with a history of GDM	Lifelong screening for diabetes or prediabetes every ≥3 years
Women with a history of GDM and prediabetes	Lifestyle interventions or metformin for diabetes prevention
Women with diabetes in the first trimester have type 2 diabetes GDM is diagnosed in the second or third trimester and not clearly associated with type 1 or type 2 diabetes	
Screening is recommended at 24-48 weeks in women who were not previously diagnosed with overt diabetes using either the one step or the two-step strategy	

Table 4: Diagnostic criteria for the 100-gram three-hour GTT to diagnose gestational diabetes mellitus

	Plasma or serum glucose level Carpenter/Coustan		Plasma level National Diabetes Data Group	
	mg/dL	mmol/L	mg/dL	mmol/L
Fasting	95	5.3	105	5.8
One hour	180	10.0	190	10.6
Two hours	155	8.6	165	9.2
Three hours	140	7.8	145	8.0

To identify pregnant women at risk for developing diabetes mellitus before or after pregnancy, O'Sullivan and Mahan's diagnostic criteria for GDM were used in 1964. According to the thresholds used (mean + 2 SD for each OGTT value), the frequency of GDM in that group would be modest and comparable to that of diabetics. The fifty gram, one hour glucose challenge test was compared to the usage of "risk factor" and blood glucose measurement by Wilkerson and O'Sullivan[34]. (GCT). The use of glucose testing was shown to be more accurate and sensitive, and it eventually led to the development of a GCT[60] threshold that could recognise 79% of people with GDM.

Studies demonstrating enhanced platelet activity in DM have led to the investigation of MPV levels in GDM. High MPV levels have been observed in DM

patients, and MPV has also been linked to diabetes independently. Additionally, a link between MPV and DM severity was discovered. Mean Platelet Volume (MPV) has been used in numerous studies to forecast GDM[11].

Mean platelet volume (MPV) was compared between type 2 diabetes and non-diabetic patients by Papanas N et al in 2004[35] in order to better understand the relationships between MPV and diabetic problems. They divided the 416 patients into 2 groups. Group A's 265 Type 2 diabetics (131-men) had an average age of 67.4±9.5 years and had had the disease for an average of 14.5±5.7 years. The average age of 151 non-diabetic patients in Group B was 68.6±9.1, and 74 of them were men. Two blood cell counters were used to assess MPV in blood samples that had been anticoagulated with sodium citrate. They discovered that MPV was substantially greater in group A (14.2 ± 2.2 fl) than in group B (7.1±1.2 fl) (P = 0.01). In group A, MPV was significantly higher in patients with retinopathy (15.8±1.3 fl) compared to patients without retinopathy (10.9±1.1 fl), and it was also significantly higher in patients with micro-albuminuria (15.6±1.2 fl) compared to patients without micro-albuminuria (10.1±1.2 fl) (P = 0.044). However, no correlation between MPV and age, gender, duration of diabetes, or insulin reliance was discovered in group A. They concluded MPV is higher in type 2 diabetic patients than in non-diabetic patients. Among type 2 diabetic patients MPV is higher in those who have microvascular complications (retinopathy or microalbuminuria) than the ones without those complications.

Platelet count and mean platelet volume (MPV) values were compared in pregnancies with gestational diabetes and those of healthy pregnancies by Bozkurt N et al in 2006[2]**.** In a study conducted by the Department of Obstetrics and Gynecology at Gazi University, comparison was done between hundred healthy

pregnancies and hundred pregnancies with gestational diabetes. The MPV obtained from the gestational diabetes group was found to be substantially larger than the MPV value of the healthy pregnancy group (8.3±1.1 fl). The platelet count between the two groups did not differ much and was not statistically significant. Additionally, an inverse association between platelet number and MPV was discovered through the use of linear regression analysis. They came to the conclusion that more studies on the platelet function are required to better understand and treat gestational diabetes, which increases the mother's chance of acquiring Type 2 diabetes and has detrimental effects on the growing foetus.

In order to determine whether these indicators have a predictive importance for gestational diabetes mellitus**,** Erikçi AA et al. (2008)[6] evaluated the platelet count and other platelet parameters in gestational diabetic and normal pregnant women. The study included 44 pregnant women with gestational diabetes mellitus and 45 healthy pregnant women. This study showed lower platelet counts and larger mean platelet volume (MPV) values in pregnant women with gestational diabetes mellitus which were statistically significant ($p < 0.006$ and $p < 0.0001$, respectively). They came to the conclusion that platelet count and MPV are key predictors of gestational diabetes mellitus.

"In 2015 Baldane S et al.[36] evaluated the relation between MPV and the homeostasis model assessment insulin resistance index (HOMA-IR) in pregnant women. They examined the MPV levels of pregnant women with or without gestational diabetes. The study comprised 114 participants with GDM readings taken before to receiving any dietary recommendations, insulin therapy, or other hypoglycemic medications, and 76 healthy pregnant women. Compared to the control group, the MPV value in the GDM group was found to be considerably

higher (10.2 fl [8.0-12.2] vs. 9.9 fl [5.81-10.9], P = 0.004). The HOMA-IR score was found to be significantly more in the group with GDM (2.46 [1.5-5.88] vs. 1.30 [0.17-2.92], P=0.001). MPV and HOMA-IR were discovered to be positively correlated (r = 0.30, P = 0.002). They concluded that MPV was significantly increased in GDM patients when compared to non diabetic pregnant women. Furthermore, a positive correlation was found between MPV and HOMA-IR.

In 2017, Karumbaiah KP et al[37] took 180 ladies, with 90 having gestational diabetes mellitus and 90 having healthy pregnancies. In this study, compared to the control group, there was an increase in mean platelet volume (p=0.002), platelet distribution width (p=0.004), and platelet count (p=0.001) in women with gestational diabetes mellitus.

In a study conducted by Colak E. et al. in 2019[11] involving two hundred healthy pregnant women and two hundred pregnant women with gestational diabetes mellitus, the first trimester MPV levels of the GDM and control groups were compared in order to predict GDM in the first trimester. They came to the conclusion that the MPV cutoff value was 7.38 fl with a sensitivity and specificity of 70% and 60%, respectively. According to ages, MPV value was greater in the GDM group among people above the age of 28 (p=0.01) MPV can therefore be used to foretell GDM in the first trimester.

MATERIALS AND METHODS

Study site: The current study is conducted in the department of Obstetrics andGynaecology at R. L. Jalappa Hospital, Kolar.

Study population: This is a comparative study performed on 138 antenatal women in their second and third trimesters of pregnancy after 20 weeks of gestational age till term 69 women with gestational diabetes mellitus and 69 women with normal pregnancies were enrolled into the study.

Study design: The current study was a comparative study

Sample size:

There are 2 groups considered,

Group A – 69 singleton pregnancy with gestational diabetes mellitus after 20 weeks of pregnancy (GDM cases)

Group B- 69 singleton pregnant women after completed 20 week of gestation without any co morbidities (normal cases group)

Formula

$$n = \frac{2s_p^2\left[z_{1-\alpha/2} + z_{1-\beta}\right]^2}{\mu_d^2}$$

$$s_p^2 = \frac{s_1^2 + s_2^2}{2}$$

Where,

S_1^2 : Standard deviation in the first group

S_2^2 : Standard deviation in the second group

μ_d^2 : Mean difference between the samples

α : Significance level

1- β : Power

Sampling method: All the eligible subjects were recruited into the studyconsecutively by convenient sampling till the sample size is reached.

Study duration: The data collection for the study was done between January 2021 to December 2022 for a period of 1 year.

Inclusion Criteria:

1. There are 2 groups considered

Group A –69 pregnancy with gestational diabetes mellitus including overt diabetes mellitus

Group B-69 normal pregnant women

Exclusion criteria:

1. Women with systemic diseases- a. collagen tissue disease

   b. heart disease

   c. renal disease

   d. hepatic disease

2. Women with poor obstetric history requiring medication during gestation(recurrent pregnancy loss)

3. Previous occurrence of - a. preterm labour

   b. Intrauterine fetal demise

Ethical considerations:

Study was approved by institutional human ethics committee. Informed written consent was taken from all the participants and only those participants willing to sign the informed consent were included in the study. The risks and benefits associated in the study and voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Data collection tools:

All the relevant parameters were documented in a structured study proforma.

Methodology:

After the written informed consent and the patient fulfilling the inclusion criteria were included in the study. A minimum of 69 normal healthy pregnant women and 69 patients with gestational diabetes mellitus were considered. A detailed clinical history along with the antenatal examination were done. The GRBS readings were documented.

Complete blood count was sent for all the patients and WBC, platelet count, MPV, PDW, PCT, P-LCR were documented in all patients. Then a comparison was made between the platelet indices of normal pregnant women and women with gestational diabetes mellitus. An attempt was made to find out whether there was an association between platelet indices and the severity of diabetes.

Statistical Methods:

Fetal outcome, place where baby was shifted post-delivery and maternal outcome were considered as primary outcome variable.

Age, gestational age, platelet count, MPV (fl), PDW (fl), P-LCR (%) and mode of delivery was considered as other study relevant variables.

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[1].

RESULTS

A total of 138 participants were included in the final analysis with 69participants in each group A (GDM cases group) and Group B (Normal cases group).

Statistical analysis:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. **Chi-square test or Fischer's exact test** (for 2x2 tables only) was used as test of significance for qualitative data.

Continuous data was represented as mean and standard deviation. **Independent t test** was used as test of significance to identify the mean difference between two quantitative variables

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs

P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

RESULTS

Table no5:- Distribution of subjects according to age group among two groups

Age in years	GDM cases		Normal cases	
	N=69	%	N=69	%
19-20yrs	2	2.9	16	23.2
21-25yrs	12	17.4	29	42.0
26-30yrs	32	46.4	18	26.1
31-35yrs	21	30.4	6	8.7
36-40yrs	2	2.9	0	0

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 upto 42% of all the cases.

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

Figure no 2:- Graph showing Distribution of subjects according to age group among two groups.

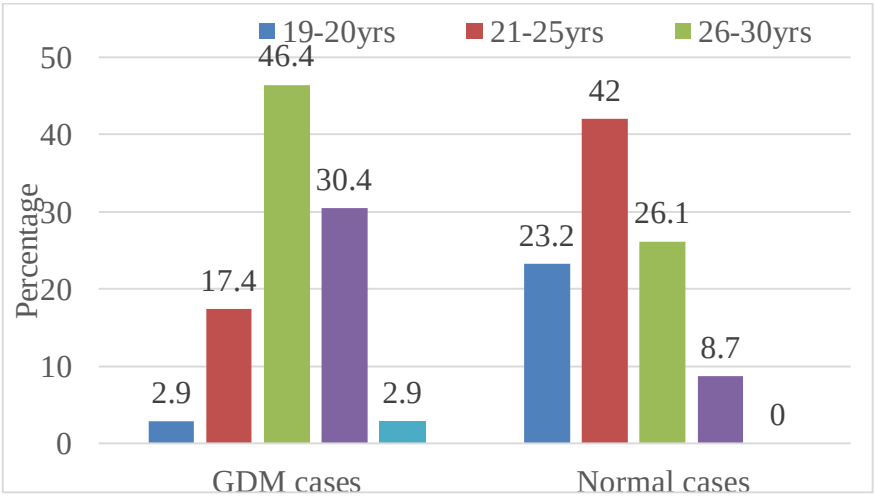


Table no 6:- Distribution of subjects according to gestational age among two groups

Gestational age in Weeks	GDM cases		Normal cases	
	N=69	%	N=69	%
28-36 weeks	18	26.1	15	21.7
36^{+1}- 40 weeks	51	73.9	50	72.5
>40 $^{+1}$ weeks	0	0	4	5.8

In the present study, around 73.9% of the GDM population was term, with the gestational age between 36^{+1} weeks to 40 weeks. In the normal group also 72.5% of the study population were of term gestation. P value 0.118, there was no statistically significant difference found between GDM cases group and Normal Cases group with respect to gestational age.

Figure no 3:- Graph showing Distribution of subjects according to gestational age among two groups

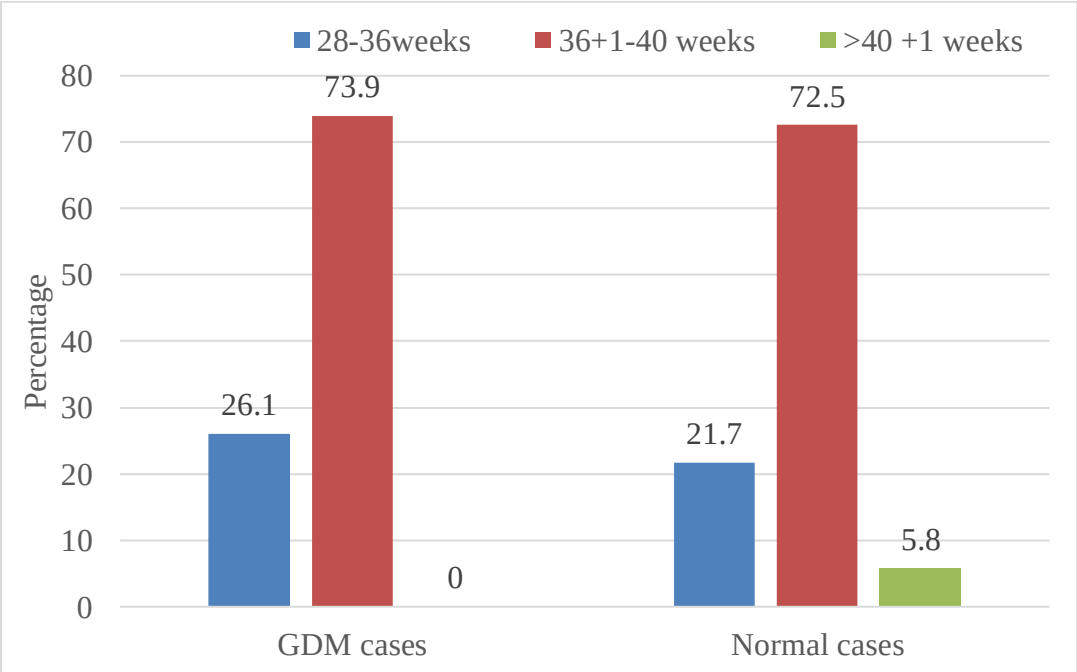


Table no 7:- Distribution of subjects according to parity among two groups

Parity	GDM cases		Normal cases	
	N=69	%	N=69	%
Primi Gravida	22	31.9	32	46.4
Gravida 2	26	37.7	23	33.3
Gravida 3	12	17.4	10	14.5
Gravida 4	7	10.1	3	4.3
Gravida 5	2	2.9	1	1.4

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

P value 0.386, there was no statistically significant difference found between GDM cases group and Normal Cases group with respect to parity.

Figure no 4:- Graph showing Distribution of subjects according to parity among two groups

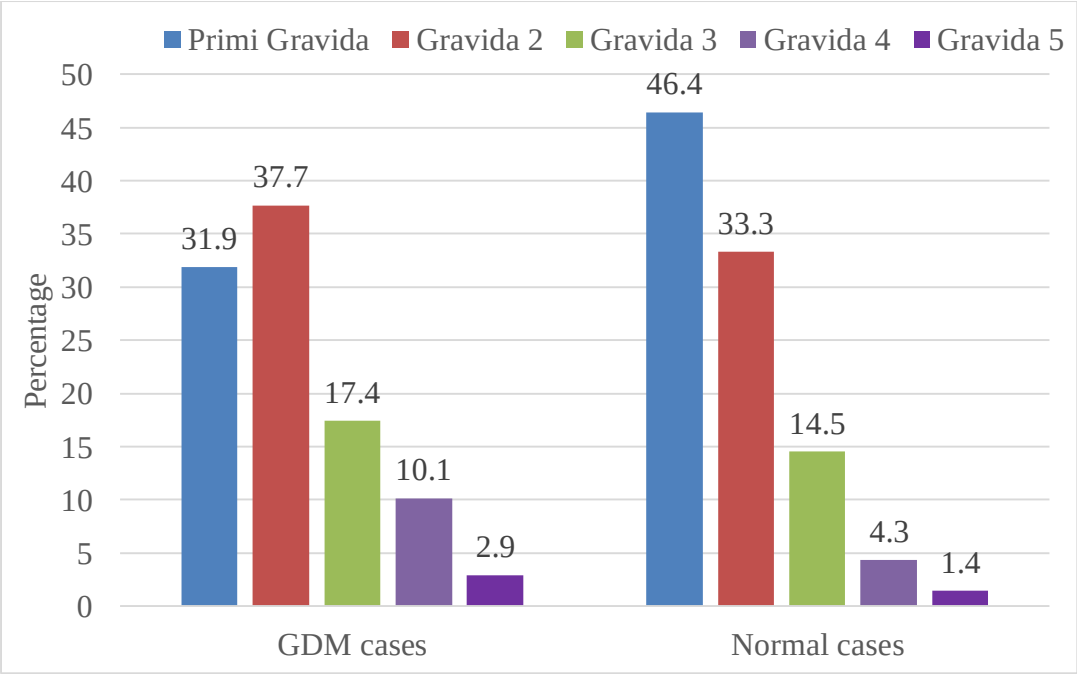


Table no 8:- Distribution of subjects according to platelets among two groups

Platelet count per mm^3	GDM cases		Normal cases	
	N=69	%	N=69	%
0.5-1lakh	5	7.2	0	0
1-1.5lakh	43	62.3	1	1.4
1.6-2lakh	21	30.4	6	8.7
2-2.5lakh	0	0	22	31.9
2.6-3lakh	0	0	25	36.2
>3lakh	0	0	15	21.7

In the present study, GDM group had platelet value of 1-1.5 lakh mm^3 as the highest, coming upto 62.3%, followed by 1.6-2 lakh mm^3, 30.4% of the cases. In the normal group, maximum patient had platelet of 2.6-3 lakh mm^3 coming upto 36.2%, followed by 2-2.5 lakh mm^3, 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.

Figure no 5:- Graph showing Distribution of subjects according to platelets among two groups.

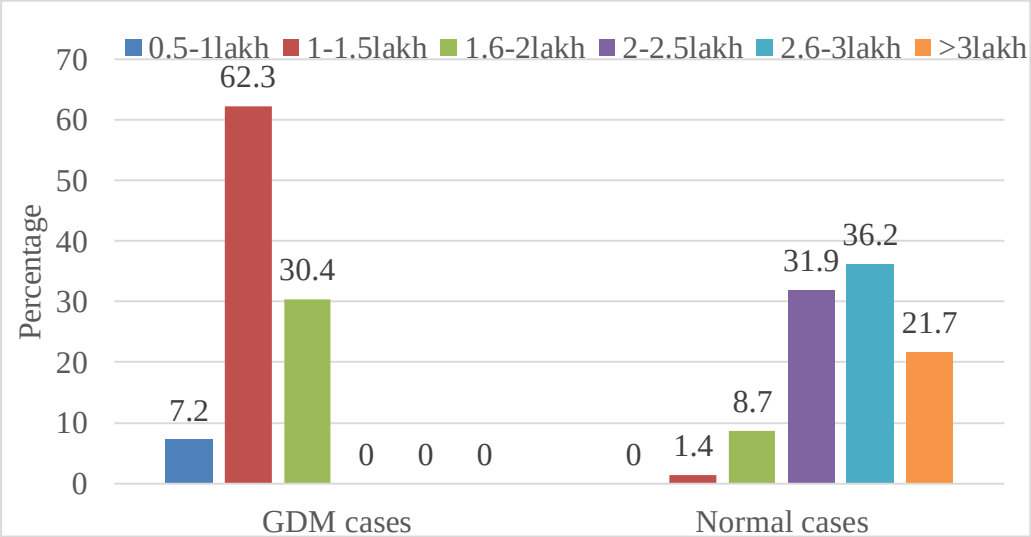


Table no 9:- Comparison of mean platelets count among GDM cases group and Normal cases groups

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	

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.

Figure no 6:- Graph showing Comparison of mean platelets count among GDM cases group and Normal cases group

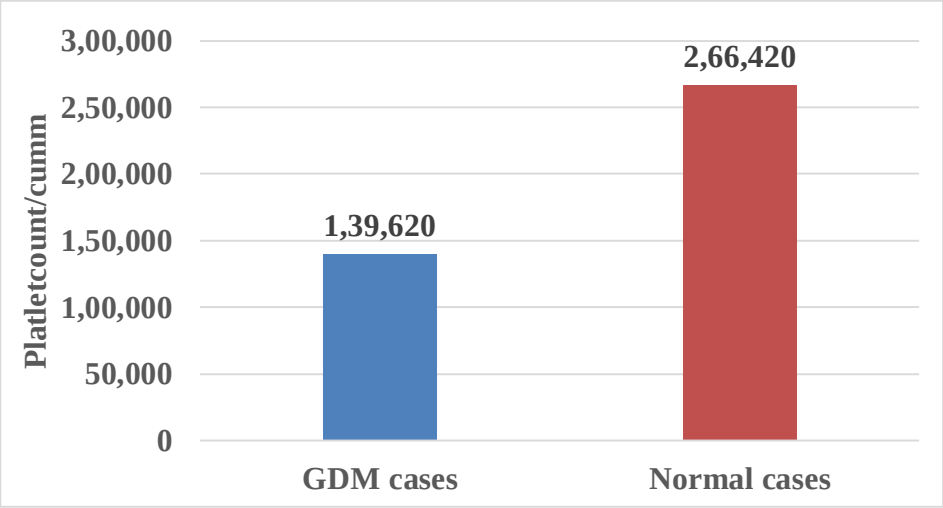


Table no 10:- Distribution of subjects according to Platelet Distribution Width among two groups

PDW(fL)	GDM cases		Normal cases	
	N=69	%	N=69	%
10	0	0	7	10.1
11	0	0	39	56.5
12	0	0	19	27.5
13	0	0	4	5.8
15	10	14.5	0	0
16	34	49.3	0	0
17	25	36.2	0	0

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.

Figure no 7:- Graph showing Distribution of subjects according to Platelet Distribution Width among two groups

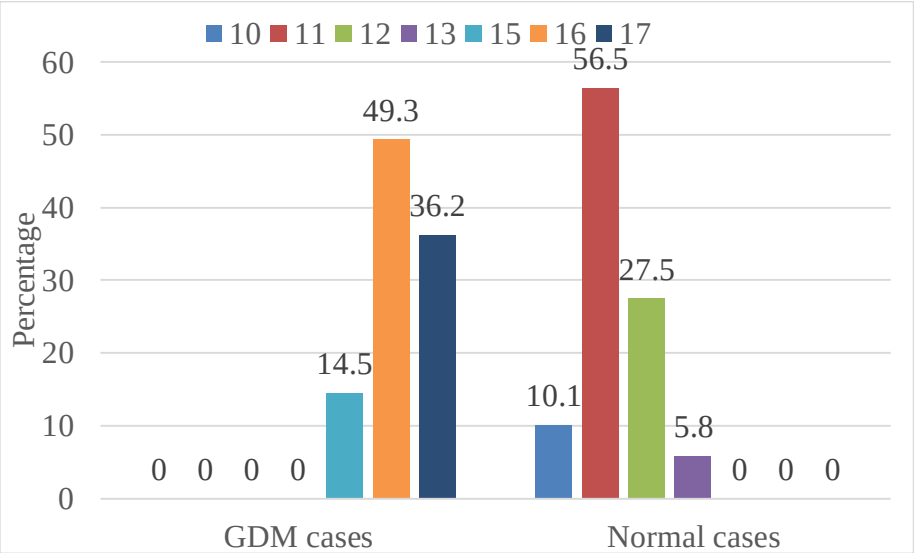


Table no 11:- Comparison of mean Platelet Distribution Width among GDM cases groups and Normal cases groups

Group	Mean PDW (fL)	SD	P Value
GDM cases	16.22	0.683	<0.001
Normal cases	11.29	0.730	

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.

Figure no 8:- Graph showing Comparison of mean Platelet Distribution Width among GDM cases groups and Normal cases groups.

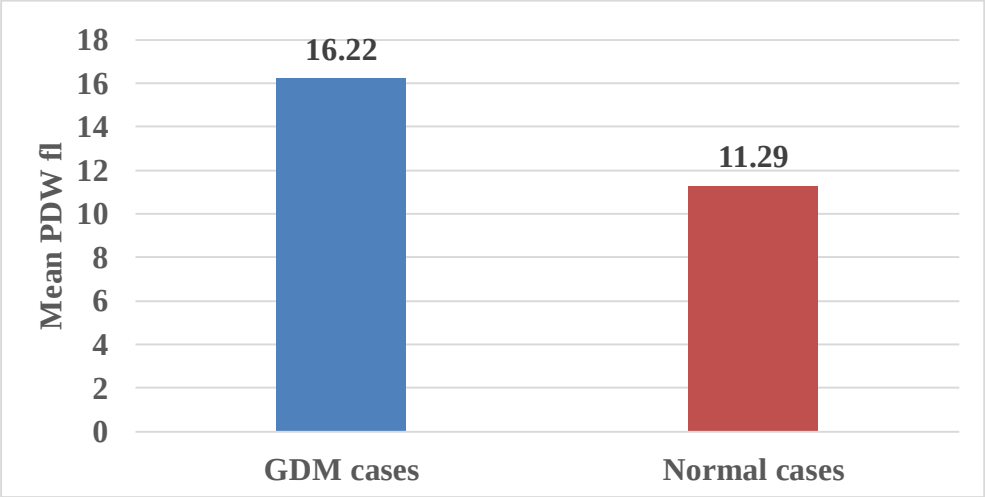


Table no 12:- Distribution of subjects according to Mean Platelet Volume among two groups

MPV (fL)	GDM cases		Normal cases	
	N=69	%	N=69	%
9	0	0	38	55.1
10	0	0	28	40.6
11	0	0	3	4.3
12	2	2.9	0	0
13	12	17.4	0	0
>13	55	79.7	0	0

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.

Figure no 9:- Graph showing Distribution of subjects according to Mean Platelet Volume among two groups

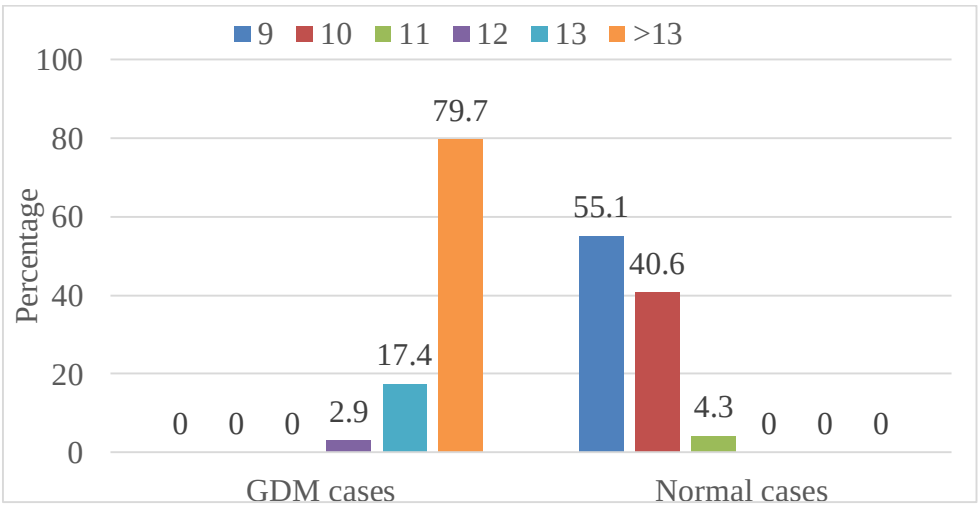


Table no 13:- Comparison of mean of Mean Platelet Volume among GDM cases groups and Normal cases groups

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

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

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

Figure no 10:- Graph showing Comparison of mean MPV among GDM cases groups and Normal cases groups.

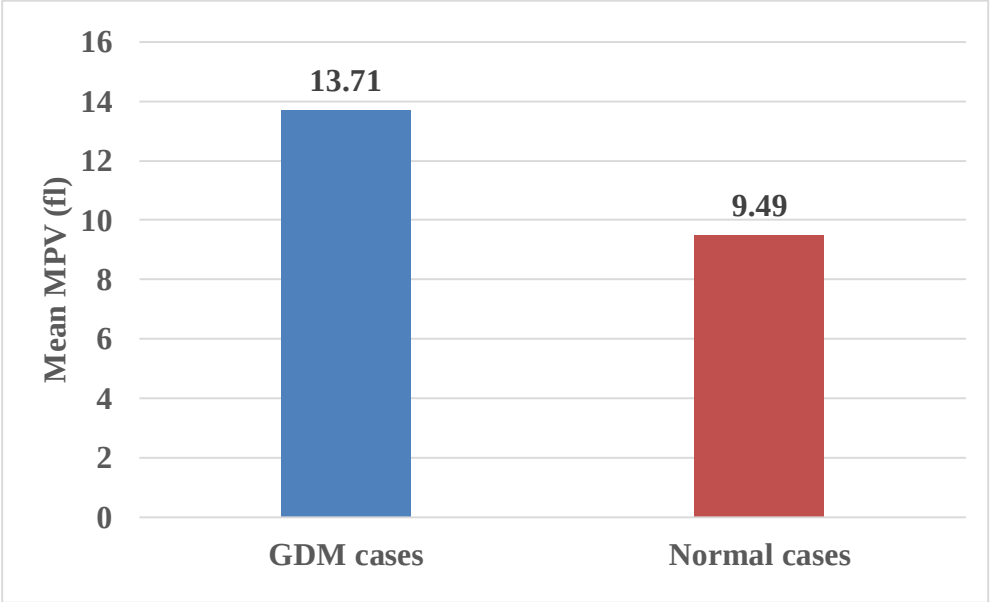


Table no 14:- Distribution of subjects according to Plateletcrit among two groups

PCT (%)	GDM cases		Normal cases	
	N=69	%	N=69	%
<0.22	50	72.5	2	2.9
0.22-0.24	16	23.2	42	60.9
>0.24	3	4.3	25	36.2

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 upto 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

Figure no 11:- Graph showing Distribution of subjects according to Plateletcrit among two groups

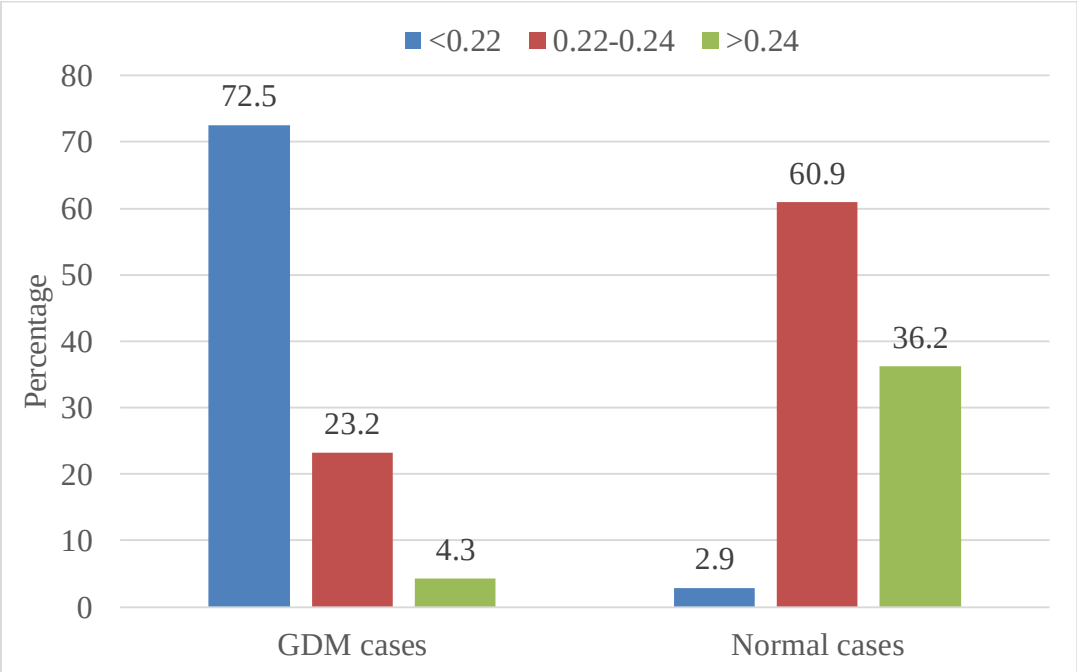


Table no 15:- Comparison of mean Plateletcrit among GDM cases groups and Normal cases groups

Group	Mean PCT(%)	SD	P Value
GDM cases	0.2154	0.01267	<0.001
Normal cases	0.2368	0.01377	

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

Figure no 12:- Graph showing Comparison of mean Plateletcrit among GDM cases groups and Normal cases groups.

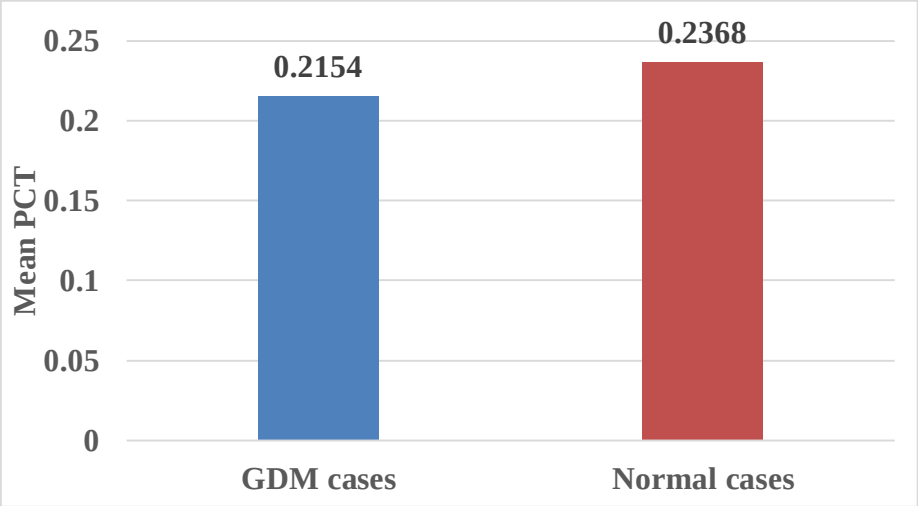


Table no 16:- Distribution of subjects according to Platelet Large Cell Ratio (P-LCR) among two groups

P-LCR (%)	GDM cases		Normal cases	
	N=69	%	N=69	%
15-20	0	0	1	1.4
21-25	2	2.9	25	36.2
26-30	28	40.6	36	52.2
31-35	34	49.3	7	10.1
>35	5	7.2	0	0

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

Figure no 13:- Graph showing Distribution of subjects according to P-LCR among two groups.

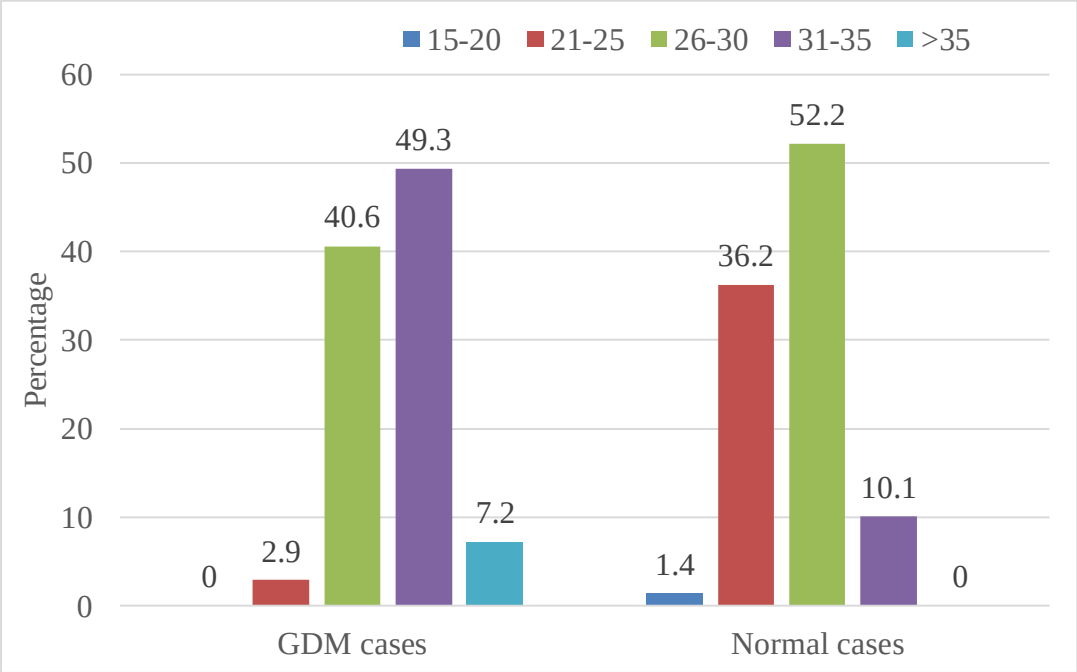


Table no 17:- Comparison of mean P-LCR among GDM cases groups and Normal cases groups

Group	Mean P-LCR(%)	SD	P Value
GDM cases	31.17	3.387	<0.001
Normal cases	26.35	3.325	

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.

Figure no 14:- Graph showing Comparison of mean P-LCR among GDM cases groups and Normal cases groups.

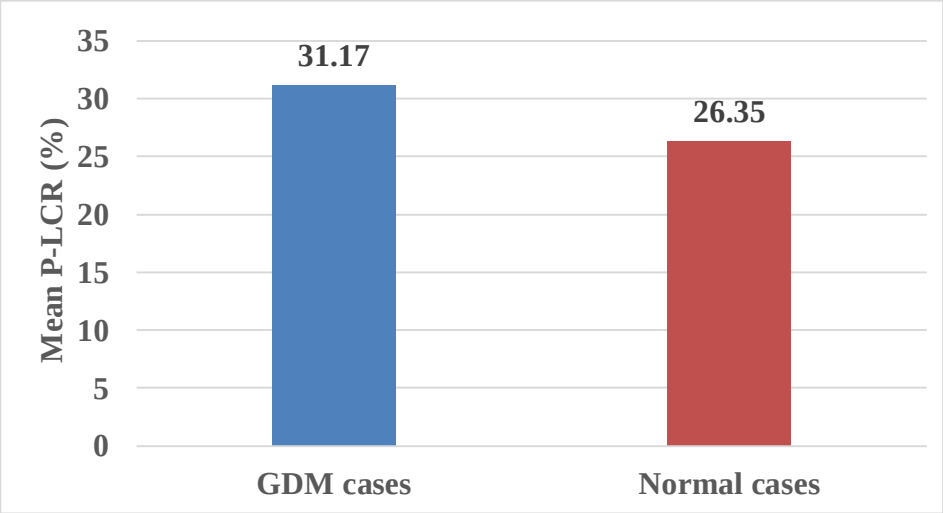


Table no 18:- Distribution of subjects according to Mode of delivery among two groups

Mode of delivery	GDM cases		Normal cases	
	N=69	%	N=69	%
Vaginal delivery	12	17.4	31	44.9
Cesarean section	57	82.6	38	55.1

Among the GDM cases, 82.6% of patients underwent Cesarean section and 17.4% had vaginal delivery. Whereas, among the normal group, 55.1% had Cesarean and 44.9% of the patients had vaginal delivery.

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

Figure no 15:- Graph showing Distribution of subjects according to Mode of delivery among two groups

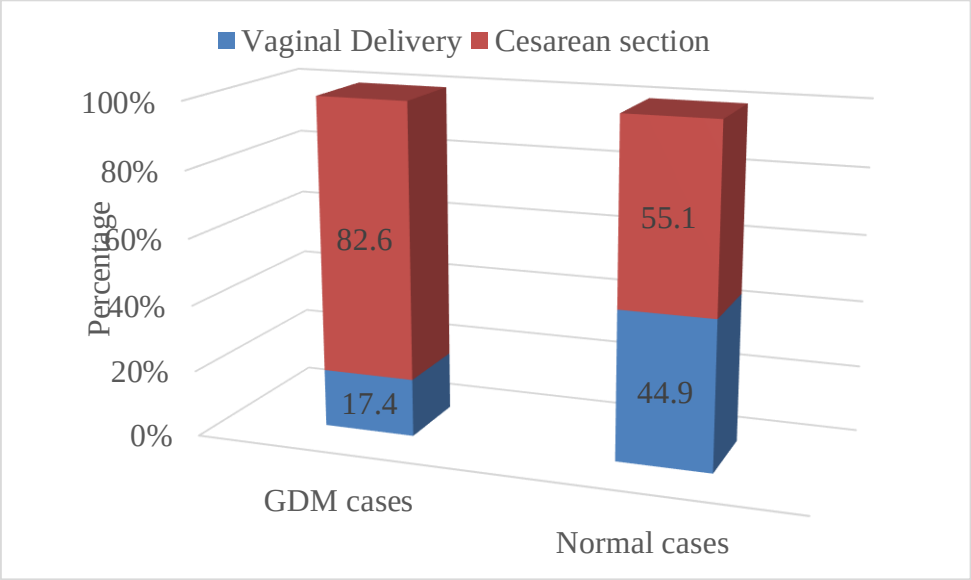


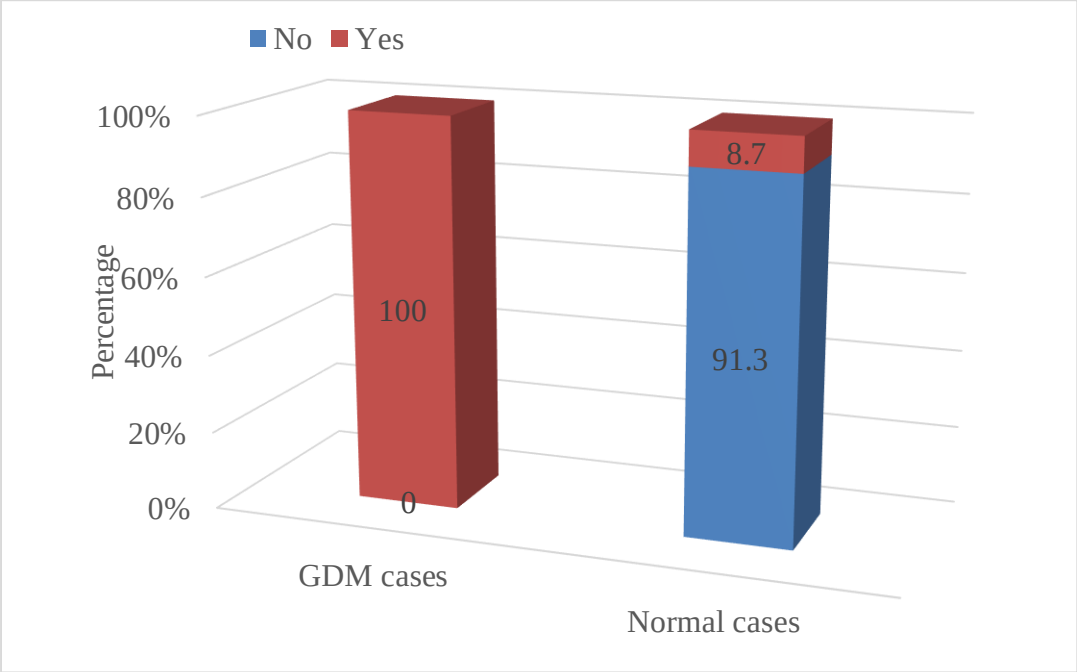
Table no 19:- Distribution of subjects according to fetal outcome among two groups

NICU admission	GDM cases		Normal cases	
	N=69	%	N=69	%
No	0	0	63	91.3
Yes	69	100.0	6	8.7

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.

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

Figure no 16:- Graph showing Distribution of subjects according to fetal outcome among two groups



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[38]. 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[39]. Many different metrics have been employed to evaluate platelet function. One of them is the straightforward technique of measuring mean platelet volume (MPV), which establishes platelet size.

Typically utilised to assess platelet morphology and serve as an indicator of platelet activity, mean platelet volume (MPV) is a simple, affordable metric derived from regular blood counts[40]. Cardiovascular illnesses and their risk factors, such as Type 2 DM, hypertension, and nonalcoholic fatty liver disease, have been shown to be associated with elevated MPV[41-43]. To determine whether MPV levels in women with GDM may be used as a marker to track and gauge the progression of GDM, a sizable number of studies recently evaluated MPV levels in these women. Studies on the connection between MPV and GDM, however, produced contradictory results. Compared to healthy pregnant women, GDM patients had considerably higher MPV, according to certain research[44,45]. However, other investigations found no correlation between MPV and GDM[46,47].

Furthermore, there are some groups that found decreased MPV values in patients with GDM[5]. According to some research, insulin resistance is a key factor in determining platelet activation, which is quantified by MPV[45]. Physiological insulin resistance, which causes increased insulin secretion and starts in the second trimester and peaks in the third, is what defines a typical pregnancy[46]. GDM results from

increased insulin production that is unable to offset the rise in insulin resistance[47].

"Both platelet count and MPV demonstrated a link with pre-eclampsia in a research by Piazze et al.[48] Women with an abnormal uterine artery Doppler who developed diabetes and PE were reported to have lower platelet counts and higher MPV, but platelet counts did not differ between these two groups. MPV was also reported to be elevated in women with an abnormal uterine artery doppler who later developed pre-eclampsia and PIH. According to a study, uterine Doppler velocimetry and periodic MPV monitoring could be used to enhance pregnancy management."

Various cardiovascular disorders have also been linked to higher MPV readings. MPV values can serve as a reliable indicator of blood sugar levels as well. Megakaryocyte stem cells from diabetes patients exhibit higher aggregation and multiplication capabilities, according to some research[6,49]. In the cell membrane of platelets with high MPV values, the glycoprotein IB molecule—a hallmark of megakaryocyte stem cells is more frequently observed in diabetes patients. According to other studies, factors including the mean platelet survival rate and the platelet manufacturing rate may affect the amount of peripheral platelets.

A systemic condition, gestational diabetes affects both the mother and the fetus. These people need to be closely watched since they are more prone to acquire Type 2 DM. Further research on platelet characteristics and functions may be useful in reducing the mortality and morbidity related to GD because an increased MPV may signify an enhanced platelet activation. DM is linked to significant metabolic and systemic hazards during pregnancy and otherwise. Pregnant women with diabetes need to have close monitoring during their antenatal visits. To avoid the complications of diabetes brought on by

hyperglycemia, which negatively affects the homeostasis of both the mother and the fetus, close monitoring is important.

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. There is a statistical difference between the GDM cases group and the Normal Cases group with respect to the age group. 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 <001)[11]. This study is not in accordance with the Kebapcilar L el. 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[44].
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^{+1} 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[50].

In the present study the highest number of cases in GDM group in this study belonged to gravida 2, accounting for upto 37.7%, whereas the highest number cases in the normal

group were primigravida, coming upto 46.4%. There was no significant difference found between GDM cases group and Normal Cases group with regard to

parity (P value 0.386). Comparable results were shown by Hoseini SSh22 et al. (2011) which showed statistically insignificant association with GDM($p = 0.10$)[51].

This study is not in accordance with Bushra Jabbar Hamarashid et al. in 2020 in which In the GDM group, 77.0% of those who participated had more than one pregnancy and 23.0% had one or more pregnancies. Additionally, in the non GDM group, 62.3% of the participants had more than one gravida and 37.7% of them had one or more gravids. 1.96 and 1.06 were the respective values for the mean and standard deviation[50].

Numerous studies have suggested that platelets may also be crucially involved in intercellular communication, inflammatory activity, and immunization[52]. Platelets are well known to perform an essential and significant function in homeostasis and thrombosis. In addition, major contributors to the pathophysiology of insulin resistance in type 2 diabetes include moderate and chronic inflammation.

High platelet counts are seen in both chronic and acute inflammation, demonstrating the importance of platelets among immunological components in controlling inflammation[53]. 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 significantly 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 170×03 /µL in GDM group as compared to control group (193.48±89.4)[54]. 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[55].

Table no 20: Comparison of mean Platelet count among GDM cases group and normal cases group

S.no.	Year	Name of the author	p-value of platelet count between GDM and normal cases group
1	2022	Present study	Significant (<0.001)
2	2022	Javid Ahmed Khan et al.[54]	Significant (0.167)
3	2012	Sak et al.[55]	Not Significant (0.567)

he 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[55].

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)] ($P = 0.004$)[36]. 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[39]. 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 the study by Celtik A et al., in 2016, no significant difference was observed in terms of MPV between women with GDM patients (8.66±1.15) and health controls (8.27±0.92). During pregnancy, the mean platelet volume was significantly higher in women with GDM than in healthy pregnant women ($p<0.05$)[49].

Table no 21:Comparison of the mean MPV between the groups of people with GDM and the normal cases.

S.no.	Year	Name of the author	P-value of Mean Platelet Volume
1	2022	Present study	Significant (<0.001)
3	2015	Baldane S et al.[36]	Significant (0.004)
4	2014	Ozlem Turhan Iyidir et al.[39]	Significant (0.002)
5	2016	Celtik A et al.[49]	Not significant (<0.05)

Compared to other platelet indices, the plateletcrit exhibited a better sensitivity and specificity. Plateletcrit provides more precise information than platelet count and mean platelet volume, while being a statistic in complete blood count that is often unknown or underutilized. The significance of platelet-related indices and their determination, which are affordable and often ordered markers, is frequently disregarded. They could be a supplement to the oral glucose tolerance test in the screening for gestational diabetes. According to Sahbaz A et al., in 2016, Statistically significant connection with the plateletcrit, MPV, and PDW and patients with GDM were found ($p<0.001$)[45]. In this study there was a significant difference found between GDM cases group (0.2154) and Normal Cases group (0.2368) with respect to mean PCT.

The result of study is in accordance to the study conducted by by Erdoğan S et al., in 2014, mean plateletcrit (PCT) levels were lower in the GDM group 0.20 as compared to healthy controls 0.25 ($P = 0.002$)[56]. Present study is not in accordance with the study conducted by Erikc¸i et al., no Statistically significant difference in plateletcrit between GDM (0.19) and control group (0.19)[6].

Table no 22: Comparing the mean Plateletcrit between groups of GDM cases and groups of normal cases

S.no.	Year	Name of the author	p-value of PCT between GDM and normal cases group
1	2022	Present study	Significant (<0.001)
2	2014	Vagdatli E et al.[56]	Significant (0.002)
3	2008	Erikc¸I et al.[6]	Not Significant(<0.05)

In the present study, 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. Regarding the fetal fate, there was a statistically significant difference between the GDM cases group and the Normal Cases group (P value 0.001). There was significant difference found between GDM cases group and Normal Cases group with respect to fetal outcome (P value <0.001). 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[44].

Our findings concur with those of Malak M. Al- Hakeem's study which indicated that GDM is linked to preterm and growth retardation is primarily responsible for the emergence of these respiratory problems, which are also linked to suboptimal maternal metabolic regulation[57].

SUMMARY

This comparative study was conducted at R. L. Jalappa Hospital and research Center, Tamaka, Kolar attached to Sri Devaraj Urs medical college from the period of January 2021 – December 2022.

As per inclusion and exclusion criteria, study performed on 138 antenatal women in their second and third trimesters of pregnancy after 20 weeks of gestational age till term 69 women with gestational diabetes mellitus and 69 women with normal healthy pregnancies were enrolled into the study .

There was a statistically significant difference found between GDM cases group and Normal Cases group with respect to age group, platelet count, mean platelet count, PDW, mean PDW, MPV, mean MPV, Mode of delivery, fetal outcome, PCT, mean PCT, P-LCR, mean P-LCR. The mean platelet count of patients with GDM was 1,39,620/mm^3 whereas the platelet count of normal healthy patients was 2,66,420/mm^3 ($p<0.001$). The mean platelet distribution width was also higher in GDM (16.22fL) as compared to normal pregnancies (11.29fL) ($p<0.001$). The Mean Platelet Volume in cases of GDM was 13.71fL, in normal pregnancy it was 9.49 fL, which is significantly higher in former group ($p<0.001$). Because of the changes in the morphology of platelet, the plateletcrit is normal pregnancy is higher (0.23%) and lower in GDM women (0.21%) ($p<0.001$). The value of P-LCR is increased in women with GDM (31.17%) as compared to the women without diabetes (26.35%) ($p<0.001$). In this study, 82.6% of GDM cases underwent caesarean section as compared to 55.1% in cases of normal pregnancy. The NICU admission of babies born to GDM mothers were 100% as they were evaluated for fetal hypoglycemia and other abnormalities, NICU admission in cases of babies of normal pregnancy was 6%.

These parameters may significantly aid the identification of diabetic pregnancy at risk for vascular complications.

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.

LIMITATION

The main limitation is small sample size and generalization of results require support of evidence from similar large studies.

Recommendation:

In order to better manage gestational diabetes mellitus and improve maternal and newborn outcomes, this study recommends using platelet indicators to diagnose it in pregnant women as early as possible.

The following are findings of the study:

Platelet count is low women with GDM in comparison with normal pregnant women.

Platelet indices like MPV and PDW are increased in women with gestational DM in comparison with normal pregnant women.

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ANNEXURE I

PATIENT CONSENT FORM

PLATELET INDICES IN GESTATIONAL DIABETES MELLITUS AND NORMAL PREGNANCY- A COMPARETIVE STUDY

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I have understood that I have the right to refuse consent or withdraw it at any time during the study and this will not affect my treatment in any way. I consent voluntarily to participate in this study

Name of Participant_____

Signature/ thumb print of Participant _____

Date _____

Statement by the researcher/person taking consent:

I have accurately read out the information sheet to the potential participant and to the best of my ability made sure that the participant understands that the following will be done: 2 ml venous blood sample taken for measurement of **platelet indices in complete blood count** that is platelet count, mean platelet volume(MPV), platelet distribution width (PDW)**,** plateletcrit (PCT), platelet large cell ratio (P-LCR).

I confirm that the participant was given an opportunity to ask questions about the study and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of Researcher/person taking the consent: Dr. Pratyusha Borthakur

Signature of Researcher /person taking the consent_____

Date _____

Name and Address of Principal Investigator:
Dr. Pratyusha Borthakur
R.L Jalappa Hospital
Tamaka, Kolar.

ಅಧ್ಯಯನ ಶೀರ್ಷಿಕೆ: "ಗರ್ಭಾವಸ್ಥೆಯ ಮಧುಮೇಹ ಮೆಲ್ಲಿಟಸ್ ಮತ್ತು ಸಾಮಾನ್ಯ ಗರ್ಭಾವಸ್ಥೆಯಲ್ಲಿ ಪ್ಲೇಟ್‌ಲೆಟ್ ಸೂಚ್ಯಂಕಗಳು- ಒಂದು ತುಲನಾತ್ಮಕ ಅಧ್ಯಯನ

ಅಧ್ಯಯನ ಸೈಟ್: ಆರ್.ಎಲ್ ಜಲಪ್ಪ ಆಸ್ಪತ್ರೆ ಮತ್ತು ಸಂಶೋಧನಾ ಕೇಂದ್ರ, ತಮಾಕಾ, ಕೋಲಾರ.

ಇದು ನಿಮಗೆ ತಿಳಿಸಲು, ನಿಮಗೆ ರಕ್ತ ತನಿಖೆ ಅಗತ್ಯ

ಗರ್ಭಧಾರಣೆಯ ಮಧುಮೇಹ ಮೆಲ್ಲಿಟಸ್ ಎಂಬ ಸ್ಥಿತಿಗೆ ನಿಮಗಾಗಿ ಚಿಕಿತ್ಸೆಯ ಯೋಜನೆಯನ್ನು ರೂಪಿಸುವುದು. ರೋಗದ ವ್ಯಾಪ್ತಿಯ ರೋಗನಿರ್ಣಯವನ್ನು ಮಾಡಲು ಮತ್ತು ಚಿಕಿತ್ಸೆಯ ಯೋಜನೆಗಾಗಿ ರಕ್ತ ತನಿಖೆ ಅಗತ್ಯಈ ಸ್ಥಿತಿಯ ಆವಿಷ್ಕಾರಗಳ ತೀವ್ರತೆ ಮತ್ತು ಪರಸ್ಪರ ಸಂಬಂಧವನ್ನು ಹಿಸಲು ನಾವು ಈ ಅಧ್ಯಯನವನ್ನು ನಡೆಸುತ್ತಿದ್ದೇವೆ.

ನೀವು ಸಿದ್ಧರಿದ್ದರೆ ನಿಮ್ಮನ್ನು ಈ ಅಧ್ಯಯನಕ್ಕೆ ದಾಖಲಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಶಸ್ತ್ರಚಿಕಿತ್ಸಾ ವಿಧಾನಗಳಿಗೆ ಅಗತ್ಯವಿರುವ ಅಲ್ಟ್ರಾಸೌಂಡ್ ಮತ್ತು ಇತರ ಸಂಬಂಧಿತ ತನಿಖೆಗಳನ್ನು ನಾವು ಮಾಡುತ್ತೇವೆ.

ನೀವು ಸ್ಟ್ಯಾಂಡರ್ಡ್ ಕೇರ್ ಪೂರ್ವ ಮತ್ತು ಪೋಸ್ಟ್ ಅನ್ನು ಆಪರೇಟಿವ್ ಆಗಿ ಸ್ವೀಕರಿಸುತ್ತೀರಿ

ಇದು ಆರಂಭಿಕ ಹಂತದಲ್ಲಿ ವ್ಯಾಸ್ಕುಲರ್ ಕಂಪ್ಲಿಕೇಶನ್ಸ್ ಮತ್ತು ಬ್ಲೀಡಿಂಗ್ ಡಯಾಸ್ಟೆಸಿಸ್ (ಯಾವುದಾದರೂ ಇದ್ದರೆ) ಅನ್ನು ಗುರುತಿಸಲು ಮತ್ತು ಚಿಕಿತ್ಸೆ ನೀಡಲು ಅನುಕೂಲವಾಗುತ್ತದೆ. ನೀವು ಅಧ್ಯಯನದ ಭಾಗವಾಗಲು ತೃಪ್ತಿ ಹೊಂದಿಲ್ಲದಿದ್ದರೆ ಅಥವಾ ಭಯಪಡದಿದ್ದರೆ ನೀವು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಅಧ್ಯಯನದಿಂದ ಹೊರಗುಳಿಯಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ. ನೀವು ಅಧ್ಯಯನದ ಭಾಗವಾಗಲು ನಿರಾಕರಿಸಿದರೆ ನಿಮ್ಮ ಚಿಕಿತ್ಸೆ ಮತ್ತು ಕಾಳಜಿಗೆ ಧಕ್ಕೆಯಾಗುವುದಿಲ್ಲ. ನೀವು ಅಧ್ಯಯನದ ಭಾಗವಾಗಿದ್ದರೆ ಅಧ್ಯಯನವು ನಿಮಗೆ ಯಾವುದೇ ಅಪಾಯ ಅಥವಾ ಆರ್ಥಿಕ ಹೊರೆ ಸೇರಿಸುವುದಿಲ್ಲ. ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ತೊಡಕು ಉಂಟಾದರೆ ರೋಗಿಗೆ ಅನುಗುಣವಾಗಿ ಚಿಕಿತ್ಸೆ ನೀಡಲಾಗುತ್ತದೆ.

ನಿಮ್ಮ ಗುರುತು ಮತ್ತು ಕ್ಲಿನಿಕಲ್ ವಿವರಗಳು ಗೌಪ್ಯವಾಗಿರುತ್ತದೆ. ಅಧ್ಯಯನದ ಭಾಗವಾಗಿರುವುದರಿಂದ ನೀವು ಯಾವುದೇ ಆರ್ಥಿಕ ಲಾಭವನ್ನು ಪಡೆಯುವುದಿಲ್ಲ. ನೀವು ಹೊಂದಿರುವ ಯಾವುದೇ ಸಂದೇಹ ಅಥವಾ ಸ್ಪಷ್ಟೀಕರಣಕ್ಕಾಗಿ ನೀವು ಡಾ.ಪ್ರತ್ಯುಷಾ ಬೋರ್ತಕೂರ್ ಅಥವಾ ಮೇಲಿನ ಸಂಶೋಧನಾ ತಂಡದ ಇತರ ಯಾವುದೇ ಸದಸ್ಯರನ್ನು ಸಂಪರ್ಕಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ.

ಡಾ.ಪ್ರತ್ಯುಷ ಬೋರ್ತಕೂರ್

ANNEXURE II

PROFORMA

- Name :
- I.P.No:
- Age:
- Occupation:
- Address:
- Husband's Occupation:
- Socio-economic Status:

- History of presenting illness:

- Menstrual history:

- Obstetric history:
- Past Medical history
- Family History:
- Personal History:
  Sleep:
  Appetite:
  Diet:
  Bowel & Bladder:

- G.P.E:

- Build: Nourishment:
- Pallor: Icterus: Cyanosis: Clubbing:
  Lymphadenopathy: Pedal edema:

- Pulse: B.P.: Temp:
- Breast: Thyroid:

Systemic examination:

- CVS:
- RS:
- CNS:

- Abdominal Examination:

- Per speculum examination:

- Per vaginum examination:

- Investigations:

- Complete blood picture with – Platelet count
  Mean Platelet Volume
  Platelet Distribution Width
  Plateletcrit
  Platelet- Large Cell Ratio

- BT, CT
- SEROLOGY
- Random Blood sugar, FBS, PPBS, HbA1c
- LFT
- Coagulation profile
- LDH
- Serum Uric acid

- Mode of delivery-

  Cesarean section

  Vaginal delivery

- Fetal outcome-

  Mother's side

  NICU admission

ANNEXURE III

KEY TO

MASTER CHART

KEYS			
A	AGE	19-20 YRS	1
		21-25 YRS	2
		26-30 YRS	3
		31-35 YRS	4
		36-40 YRS	5
B	GESTATIONAL AGE	28-36 WEEKS	1
		36^{+1} - 40 WEEKS	2
		$>40^{+1}$ WEEKS	3
C	GRAVIDA	PRIMIGRAVIDA	1
		GRAVIDA2	2
		GRAVIDA 3	3
		GRAVIDA 4 GRAVIDA 5	4 5
D	PLATELET COUNT	<=50000	1
		51000-1LAKH	2
		1.1-1.5LAKH	3
		1.5-2LAKH	4
		2-2.5LAKH	5
		2.5-3LAKH	6
		>3LAKH	7
E	PDW(fl)	10	1
		11	2
		12	3
		13	4
		14	5
		15	6
		16	7
		17	8

F	MPV(fl)	9	1
		10	2
		11	3
		12	4
		13	5
		MORE THAN 13	6
G	MODE OF DELIVERY	VAGINAL DELIVERY	1
		LSCS	2
H	FETAL OUTCOME	MOTHERS SIDE	1
		NICU	2
I	PCT (%)	<0.22	1
		0.22-0.24	2
		>0.24	3
J	P-LCR	15-20	1
		21-25	2
		26-30 31-35 >35	3 4 5

ANNEXURE IV

MASTER CHART GDM (group A)

S.NO	UHID NO	A	B	C	D	E	F	G	H	I	J
1	52783	4	2	1	2	6	5	2	2	1	3
2	48666	3	2	2	2	7	5	1	2	1	3
3	53873	3	1	2	3	7	6	2	2	1	4
4	55148	3	1	1	2	7	6	2	2	1	3
5	86542	2	2	1	3	7	6	2	2	1	4
6	84060	2	2	4	4	8	6	2	2	1	3
7	85754	2	2	3	3	8	5	2	2	1	2
8	85413	3	2	2	3	8	6	1	2	1	4
9	84726	3	2	2	3	8	6	2	2	2	4
10	84554	2	2	3	2	7	6	2	2	1	5
11	84180	4	1	3	3	7	6	2	2	2	3
12	77404	4	2	2	3	8	6	2	2	3	4
13	82352	3	2	4	3	8	6	2	2	2	3
14	23378	4	2	4	3	8	6	2	2	1	4
15	43190	2	2	3	4	8	5	2	2	1	3
16	80260	2	2	2	3	7	6	2	2	1	4
17	74160	3	2	2	3	7	6	2	2	1	3
18	80111	2	2	3	3	7	6	2	2	1	4
19	78633	3	1	2	3	7	6	1	2	1	3
20	70864	2	1	2	3	7	6	2	2	1	4
21	77760	4	2	2	3	7	4	2	2	1	3
22	75900	4	1	1	2	8	5	2	2	1	4
23	75629	3	1	2	3	8	6	2	2	1	4
24	75100	3	2	1	3	8	6	2	2	1	3
25	42098	3	2	3	3	8	6	2	2	2	4
26	39193	4	1	2	4	7	6	2	2	3	4
27	52783	3	2	1	4	8	5	2	2	1	4
28	48666	4	2	3	4	8	6	1	2	1	3
29	55148	3	2	1	3	7	6	2	2	1	4
30	55547	3	1	2	3	7	4	2	2	2	3
31	55650	3	2	2	3	8	5	2	2	1	4
32	57934	3	2	1	4	8	6	2	2	2	3
33	59247	3	2	4	4	8	6	2	2	2	4
34	59816	1	2	1	4	8	6	2	2	2	3
35	60225	4	2	2	3	8	6	2	2	1	4
36	58650	4	1	1	3	7	6	2	2	1	4
37	59651	3	2	2	3	8	6	1	2	1	4
38	62663	3	1	2	3	6	6	2	2	1	5
39	44119	2	2	4	3	7	5	2	2	1	4
40	65286	3	1	2	3	7	6	2	2	1	5
41	44904	4	2	2	4	7	6	2	2	1	4
42	52934	3	2	2	3	7	5	2	2	1	3
43	66269	5	2	5	3	6	6	2	2	1	4
44	66865	4	2	3	3	7	6	1	2	1	3
45	66908	4	1	3	4	7	6	2	2	2	4

46	67126	3	2	3	4	7	5	1	2	1	3
47	66232	4	1	1	4	7	6	2	2	1	4
48	68162	3	2	4	3	6	6	1	2	1	3
49	69956	1	2	4	4	6	6	1	2	1	3
50	68067	3	2	3	3	6	6	1	2	1	4
51	70080	3	1	2	3	7	6	2	2	2	3
52	939648	3	2	1	3	7	6	2	2	1	2
53	942686	3	2	1	3	6	6	2	2	1	3
54	936211	3	2	1	4	6	6	2	2	1	4
55	946800	4	2	1	3	7	5	2	2	1	3
56	951096	4	2	2	4	8	6	2	2	1	5
57	951492	5	2	1	3	7	6	2	2	2	4
58	951075	4	1	3	3	8	6	1	2	1	3
59	23935	4	2	1	4	7	6	2	2	1	4
60	8399	2	2	5	4	8	6	2	2	1	3
61	40188	2	1	2	3	7	6	2	2	2	3
62	46481	2	2	1	4	6	6	2	2	1	4
63	46732	3	2	1	4	6	6	2	2	3	4
64	45628	3	2	1	3	7	6	2	2	2	4
65	56503	3	2	2	4	7	6	2	2	2	3
66	51038	4	2	1	4	8	5	2	2	2	4
67	46940	4	1	1	3	8	6	2	2	1	5
68	40897	3	2	2	3	7	6	1	2	2	4
69	67517	4	2	2	3	7	6	2	2	1	3

MASTER CHART NORMAL
(group B)

S. NO	UHID NO	A	B	C	D	E	F	G	H	I	J
1	51788	1	2	1	5	2	1	1	1	2	2
2	51793	1	2	1	5	2	1	2	1	2	2
3	51806	2	2	2	6	2	1	2	1	2	3
4	51811	3	2	2	5	3	1	1	1	2	2
5	51758	3	2	3	7	2	1	1	1	3	3
6	51823	1	2	2	5	1	2	1	1	3	2
7	51820	2	2	4	7	1	2	2	1	3	3
8	51763	3	2	4	6	2	2	2	1	3	2
9	51611	3	2	2	5	2	3	2	1	2	3
10	51959	1	2	1	6	2	3	2	1	3	2
11	51796	1	1	1	7	2	2	2	1	3	4
12	52072	2	2	2	6	3	3	2	1	3	3
13	52159	3	2	2	5	2	2	2	2	3	2
14	52264	4	1	2	6	3	2	2	1	3	3
15	52471	3	2	2	4	2	2	2	2	2	2
16	50857	1	3	1	5	2	1	2	1	3	3
17	52474	2	2	1	6	2	1	1	1	3	3
18	52476	2	1	3	5	2	1	1	1	3	3
19	52689	1	2	1	6	3	1	1	1	2	2
20	49899	2	2	5	5	2	2	1	1	2	3
21	52701	1	2	1	4	3	2	2	1	2	3
22	52720	2	2	2	5	2	2	2	1	2	3
23	43546	3	1	2	7	3	1	1	1	2	2
24	43006	4	1	1	5	2	1	1	1	2	3
25	52806	4	2	3	6	3	1	2	1	3	3
26	52824	4	2	1	5	4	2	2	1	2	2
27	51910	2	2	1	7	4	1	1	1	2	3
28	52896	2	2	3	6	4	1	1	1	2	3
29	37377	3	2	1	6	3	2	2	1	2	2
30	53162	3	2	1	7	2	1	2	1	3	4
31	53209	2	1	2	6	2	2	2	2	2	2
32	53070	2	2	1	7	2	1	1	1	2	3
33	53342	2	2	2	5	3	2	2	1	2	3
34	52138	2	3	3	5	2	1	1	1	2	3
35	45546	1	1	1	6	3	2	2	1	3	2
36	53629	2	2	1	4	3	1	2	1	3	3
37	53656	1	2	2	5	3	2	2	1	3	3
38	53652	2	2	2	3	3	1	2	1	3	2
39	53792	1	1	1	4	1	2	2	1	3	3
40	53818	2	2	2	6	2	1	1	1	3	3
41	53814	2	2	2	5	2	1	2	1	3	3
42	53888	1	1	1	6	3	2	1	1	3	2
43	47030	3	2	2	5	2	1	2	1	2	3
44	54075	1	2	2	6	2	1	1	1	2	3

45	54072	2	2	1	6	2	2	2	1	2	3
46	54076	2	2	1	4	3	1	2	1	2	2
47	51566	1	1	1	5	2	1	1	1	2	3
48	54227	2	3	1	5	2	2	2	2	2	3
49	54284	3	2	1	6	2	1	2	1	2	2
50	37425	3	2	2	5	3	1	2	1	2	2
51	47823	3	2	1	6	2	1	1	1	2	2
52	54352	3	1	1	6	4	2	1	1	2	1
53	53961	4	1	2	7	2	2	1	1	1	3
54	55176	3	2	1	7	2	2	2	1	2	3
55	55307	3	2	2	7	3	1	1	1	2	4
56	47860	3	2	3	5	2	1	1	1	2	3
57	55340	2	2	2	7	2	1	1	1	2	3
58	40733	2	2	3	6	3	1	1	1	2	4
59	55758	1	2	4	7	2	1	2	1	2	4
60	55525	2	1	3	7	2	1	1	1	2	2
61	55795	1	1	3	4	2	2	2	1	2	3
62	50871	2	3	3	5	2	2	2	1	2	4
63	42634	2	2	1	6	2	1	1	1	1	2
64	55904	2	2	1	6	3	1	1	1	2	3
65	56050	3	2	1	6	1	1	1	1	2	2
66	56164	2	2	1	7	1	2	1	1	2	3
67	56165	4	2	1	6	2	2	2	1	3	4
68	56179	2	1	2	7	1	2	1	2	3	2
69	37435	2	2	1	6	1	1	2	2	3	2