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Original Article

Maternal and Fetal Outcomes in Hyperglycemia in Pregnancy

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ABSTRACT

Background: Hyperglycemia in pregnancy (HIP), particularly gestational diabetes mellitus (GDM), is one of the most common metabolic disorders complicating pregnancy and is associated with increased maternal and neonatal morbidity. Poor glycemic control can lead to adverse maternal outcomes such as urinary tract infections, vaginal candidiasis, preeclampsia, polyhydramnios, preterm labor, and premature rupture of membranes (PROM), while fetal complications include macrosomia, respiratory distress syndrome, hyperbilirubinemia, and neonatal intensive care unit (NICU) admission. Early diagnosis and appropriate management are essential to improve pregnancy outcomes.

Objectives: To assess the maternal outcomes associated with hyperglycemia in pregnancy, including vaginal candidiasis, symptomatic urinary tract infection (UTI), PROM, preterm labor, polyhydramnios, and preeclampsia, and to evaluate fetal outcomes in terms of macrosomia, hyaline membrane disease, and hyperbilirubinemia.

Materials and Methods: A prospective observational study was conducted over 18 months among 95 pregnant women diagnosed with hyperglycemia in pregnancy attending the antenatal clinic at Dr. B. R. Ambedkar Medical College and Hospital. Women with singleton pregnancies up to 28 weeks' gestation and a 2-hour plasma glucose level >140 mg/dL following a 75-g oral glucose challenge test were included. Demographic, clinical, laboratory, obstetric, and neonatal data were collected and analyzed using SPSS version 21. Statistical significance was considered at $p < 0.05$.

Results: Among the 95 participants, 52.6% were older than 30 years. Vaginal delivery was observed in 54.7% of cases, while 45.3% underwent lower segment cesarean section. The most common maternal complications were vaginal candidiasis (36.8%) and urinary tract infection (23.2%), followed by polyhydramnios, preterm labor, PROM, and preeclampsia. Fetal complications included hyaline membrane disease (11.6%), hyperbilirubinemia (9.5%), and macrosomia (5.3%). Polyhydramnios demonstrated a statistically significant association with mean OGTT values ($p = 0.009$), whereas no significant associations were found between OGTT values and other maternal or fetal complications.

Conclusion: Hyperglycemia in pregnancy remains an important contributor to maternal and neonatal morbidity. Universal screening, early diagnosis, strict glycemic control, and multidisciplinary management can significantly reduce adverse pregnancy outcomes. Long-term follow-up of both mothers and offspring is essential to prevent future metabolic disorders and improve overall maternal and child health.

Keywords: *Hyperglycemia in Pregnancy; Gestational Diabetes Mellitus; Maternal Outcomes; Fetal Outcomes; Oral Glucose Tolerance Test.*

INTRODUCTION

Hyperglycemia in pregnancy (HIP) is one of the most prevalent medical disorders complicating pregnancy and encompasses gestational diabetes mellitus (GDM) as well as diabetes first recognized during pregnancy. Gestational diabetes mellitus is defined as glucose intolerance with onset or first recognition during pregnancy and accounts for the majority of cases of hyperglycemia in pregnancy. The prevalence of GDM has increased globally due to rising maternal age, obesity, sedentary lifestyles, and changing dietary patterns. In India, the prevalence varies widely from 5% to 28%, depending on the population studied and the diagnostic criteria used.

Pregnancy is characterized by progressive insulin resistance, particularly during the second and third trimesters, mediated by placental hormones such as human placental lactogen, cortisol, progesterone, and prolactin. In women unable to compensate with increased pancreatic insulin secretion, hyperglycemia develops, leading to gestational diabetes mellitus. Maternal hyperglycemia increases the transfer of glucose across the placenta, stimulating fetal pancreatic insulin secretion. Fetal hyperinsulinemia contributes to excessive fetal growth, altered metabolic adaptation after birth, and several neonatal complications.

Hyperglycemia in pregnancy is associated with numerous maternal complications, including urinary tract infections, vaginal candidiasis, hypertensive disorders, polyhydramnios, preterm labor, premature rupture of membranes, increased operative deliveries, and postpartum metabolic dysfunction. Neonates born to mothers with GDM are at increased risk of macrosomia, birth trauma, respiratory distress syndrome (hyaline membrane disease), neonatal hypoglycemia, hyperbilirubinemia, electrolyte disturbances, NICU admission, and long-term risks of obesity and type 2 diabetes mellitus.

Timely screening, early diagnosis, appropriate nutritional therapy, lifestyle modification, glucose monitoring, and pharmacological treatment when required have been shown to significantly improve maternal and neonatal outcomes. Universal screening using the 75-g oral glucose tolerance test (OGTT), as recommended by the Diabetes in Pregnancy Study Group India (DIPSI), is considered particularly suitable in the Indian population because of the high prevalence of GDM and the feasibility of implementing a single-step diagnostic approach.

Despite advances in obstetric care, hyperglycemia in pregnancy continues to pose substantial challenges in developing countries. Evaluating maternal and fetal outcomes among women with hyperglycemia provides valuable information for optimizing antenatal management and reducing pregnancy-related complications. Therefore, the present prospective observational study was undertaken to assess the maternal and fetal outcomes associated with hyperglycemia in pregnancy and to determine the relationship between maternal glycemic status and adverse pregnancy outcomes.

OBJECTIVES

To assess the various maternal outcomes in hyperglycemia of pregnancy such as Vaginal candidiasis, Symptomatic UTI, PROM, Preterm labor, Polyhydramnios. Preeclampsia.

To assess the various fetal outcome in terms of Macrosomia, Hyaline membrane disease , Hyperbilirubinemia

MATERIALS AND METHODS

Study Duration: The study was done for a period of 18months

Source of Data: All pregnant females visiting antenatal clinic At Dr. BR Ambedkar Medical college and hospital during study period.

Study Design: This is a Prospective Observational Study done in 95 patients

Sample Size:
Where,
nis the sample size,
Zisthestatisticcorrespondingtolevelofconfidence, p is expected prevalence, and
d=desired precision

Inclusion criteria

- Pregnancy withup to28weeks of gestation.

- Singleton pregnancy
- Subjects with blood glucose level>140mg/dl 2hrs after 75gms glucose challenge test

Exclusion criteria
- Already known cases of diabetes
- Women with multiple pregnancies
- Women with chronic diseases such as chronic renal failure, liver diseases, HIV, other immune compromised status, haemoglobinopathies

Methods of Data collection
Institutional Ethical Review Board approval was obtained prior to initiation of the study. All the patients fulfilling the inclusion criteria were included in the study after their consent of participating and willingness to undergo required investigations as a part of the study.

The data was captured in the case record form[CRF], that were broadly classified into

Demographic Characteristics: Name, age, sex, address, contact details, monthly income, languages known, occupation, educational level, rural/urban, religion.
Patient history–Medicalhistory, familyhistory, menstrualhistory, marital history, obstetric history, personal history on diet, appetite, sleep and habits was noted
Clinical symptoms–complaints if any were noted down.
Examination: general physical examination, vitals, systemic examination, oer Speculum examination was done

Investigations–Hb, totalcount, OGCT, urine routine and culture sensitivity and USG findings was noted.

STATISTICAL ANALYSIS
Data is analyzed using SPSS software version 21 and Excel. Categorical variables are given in the form of frequency table. Continuous variables are given in Mean ± SD/ Median (Min, Max) form. Normality was checked by Shapiro wilk test. If the data follows normality then Pearson test will be done, otherwise non-parametric test Spearman's rho correlation test will be used. P-value less than or equal to 0.05 indicates statistical significance.

RESULTS
Our results have data of 95 participants

Table10: Age group of the Study Population

AgeGroup	Frequency	Percentage(%)
< 30YEARS	45	47.4
>30YEARS	50	52.6
Total	95	100.0

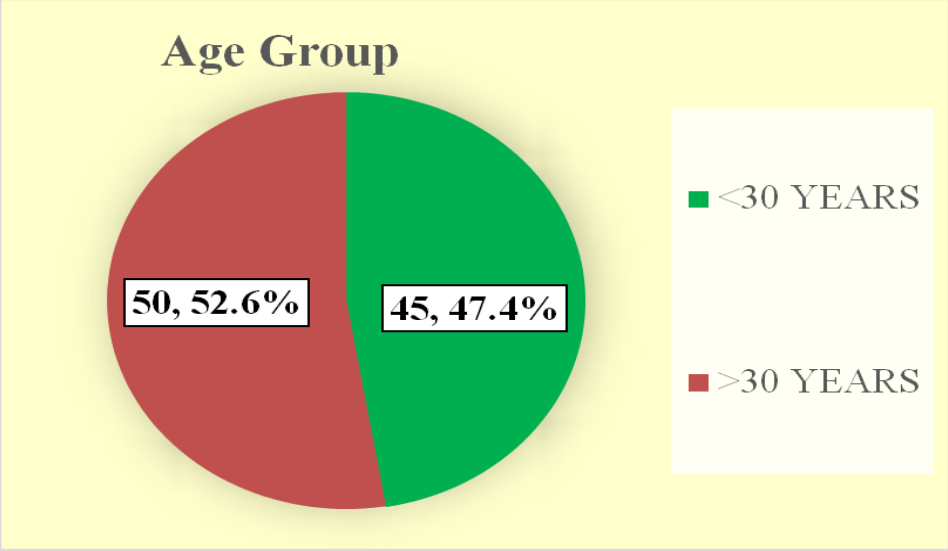

Fig6 : Age group of the Study Population

The age distribution of the study participants shows a fairly balanced split, with aslightly higher proportion of individuals aged over 30years. Specifically, 47.4%(n=45) of the Participants were under 30 years of age, while 52.6%(n=50) were over 30 years of age.

Table11: Gestational Score of the Study Population

Gestational Score		Frequency	Percentage(%)
GRAVIDA	1	28	29.5
	2	18	18.9
	3	25	26.3
	4	24	25.3
PARA	0	23	24.2
	1	29	30.5
	2	24	25.3
	3	19	20.0
LIVING	0	17	17.9
	1	25	26.3
	2	30	31.6
	3	23	24.2
ABORTION	0	35	36.8
	1	30	31.6
	2	30	31.6

The gestational score data provides insight into the obstetric history of the participants. Among the gravida scores, most participants were either gravida 1 (29.5%) or gravida 3 (26.3%), with smaller yet significant portions being gravida 2 (18.9%) and gravida 4(25.3%),indicatingavariedreproductivehistory.Forthepara-scores,thehighestproportion had one previous delivery (30.5%), followed by those with two (25.3%), and 24.2% had never delivered (para 0), while 20% had three prior deliveries. Regarding living children, the largest group had two living children (31.6%), followed by one (26.3%) and three (24.2%), with 17.9% reporting no living children. In terms of abortion history, 36.8% of participants had no abortions, while 31.6% had experienced one or two each, reflecting a fairly even distribution among those with a history of abortion.

Table12: Socio-economic status of the Study Population

Socio-economicstatus	Frequency	Percentage(%)
High	28	29.5
Low	35	36.8
Middle	32	33.7
Total	95	100.0

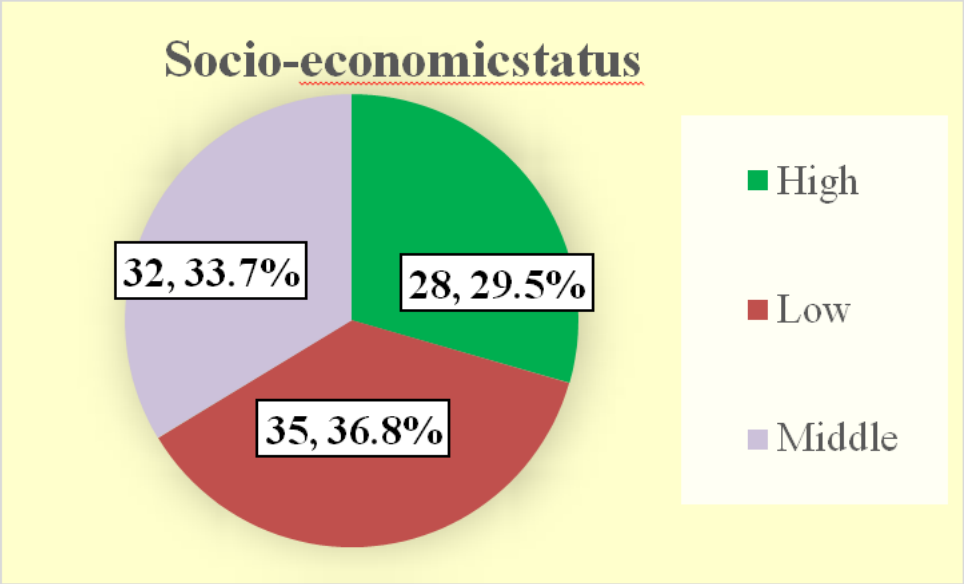

Fig 7: Socio-economicst atus of the Study Population

The data on socio-economic status among the study participants shows a fairly balanced distribution across the three categories. A majority of participants belonged to the low socio-economic group (36.8%), followed closely by those in the middle class (33.7%). The high socio-economic group constituted 29.5% of the sample. This near-even spread suggests that the study encompasses a diverse population in terms of economic background, which may influence various health-related outcomes, including access to care, nutrition, and overall maternal and neonatal health.

Table13:Dietarypattern of the Study Population

Dietarypattern	Frequency	Percentage(%)
Non-Veg	55	57.9
Veg	40	42.1
Total	95	100.0

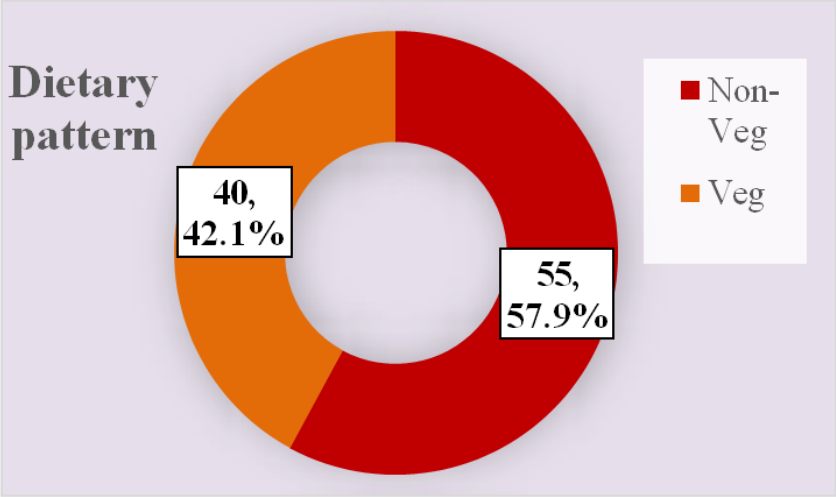

Fig8: Dietary pattern of the Study Population

The data on dietary patterns indicates that a majority of the participants (57.9%) consumed a non-vegetarian diet, while 42.1% followed a vegetarian diet. This distribution highlights a predominance of non-vegetarian dietary habits among the study population, which may have implications for nutritional status, especially in relation to protein and micronutrient intake factors that can influence maternal and fetal outcomes.

Table14: Mode of delivery among Study Population

Mode of Delivery	Frequency	Percentage(%)
LSCS	43	45.3
Vaginal	52	54.7
Total	95	100.0

The data on mode of delivery shows that 54.7% of the participants had a vaginal delivery, while 45.3% underwent lower segment cesarean section (LSCS). This relatively balanced distribution suggests a moderately high rate of cesarean deliveries, which could reflect underlying maternal or fetal indications, healthcare practices, or patient preferences within the studied population.

Table15: Various Maternal Conditions in the study population

Maternal Conditions		Frequency	Percentage(%)
Vaginal Candidiasis	No	60	63.2
	Yes	35	36.8
UTI	No	73	76.8
	Yes	22	23.2

Polyhydramnios	No	80	84.2
	Yes	15	15.8
PROM	No	84	88.4
	Yes	11	11.6
Pre-Eclampsia	No	88	92.6
	Yes	7	7.4
Pre-termlabor	No	81	85.3
	Yes	14	14.7

The data on maternal conditions indicates that the most commonly reported issue was vaginal candidiasis, affecting 36.8%of the participants, followed by urinary tract infections (UTIs)in 23.2%. Poly hydramnios was observed in 15.8%, and pre-term labor in 14.7% of cases. Less frequent conditions included premature rupture of membranes (PROM) at 11.6%, and pre-eclampsia, which was present in only 7.4% of the population. Overall, while the majority of mothers did not experience these complications, a significant portion faced infections or pregnancy-related issues, highlighting the importance of antenatal screening and timely intervention.

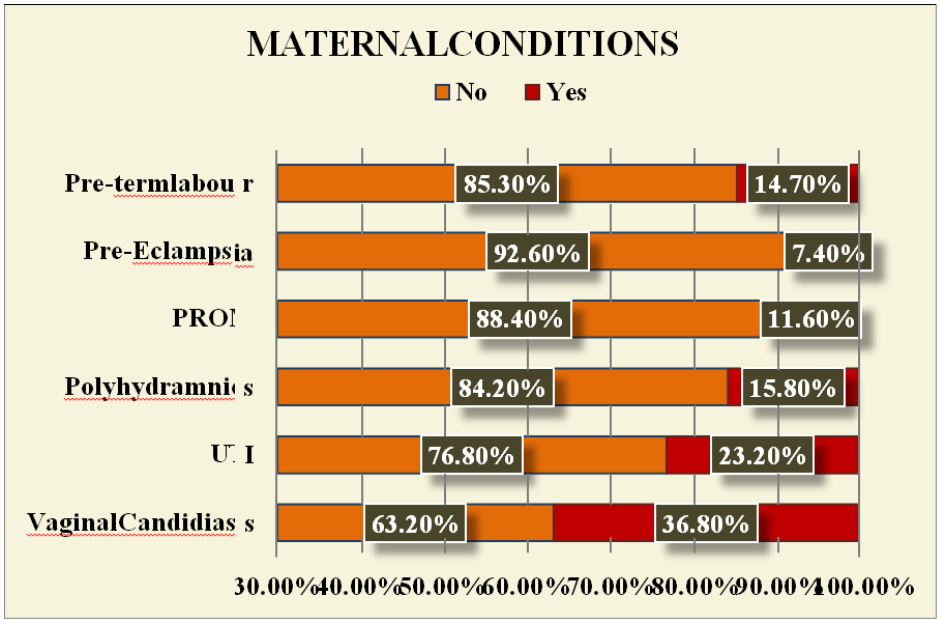

Fig9: Maternal conditions

Table16: Various Fetal Conditions in the study population

Fetal Conditions		**Frequency**	**Percentage(%)**
Macrosomia	No	90	94.7
	Yes	5	5.3
Hyaline membrane disease	No	84	88.4
	Yes	11	11.6
Hyperbilirubinemia	No	86	90.5
	Yes	9	9.5

The data on fetal conditions shows that macrosomia was relatively uncommon, occurring in only 5.3% of cases. Hyaline membrane disease was noted in 11.6%, while hyper bilirubinemia affected 9.5% of the newborns. The vast majority of fetuses did not exhibit these conditions, suggesting generally favorable neonatal outcomes in this cohort. However, the presence of respiratory and metabolic issues in a minority indicates the

need for vigilant neonatal monitoring and care post-delivery.

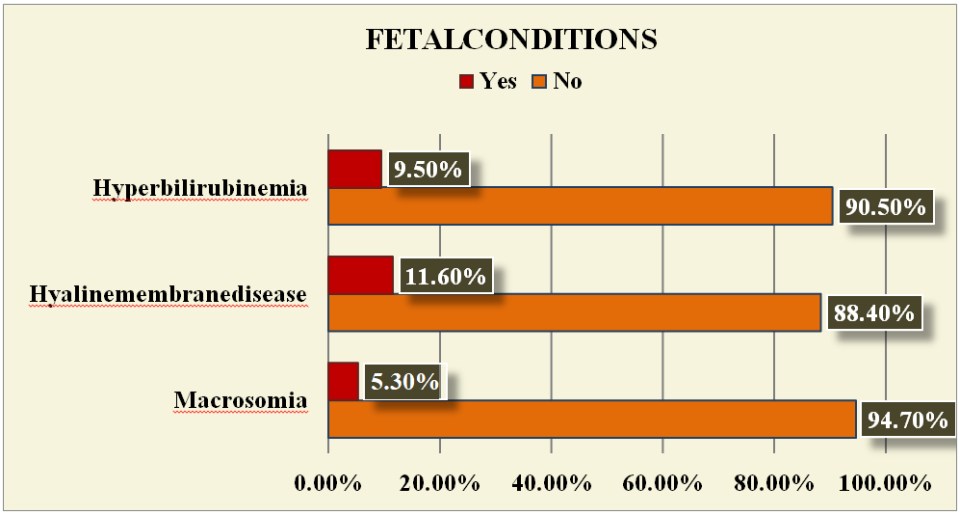

Fig:10 Fetal condition

Table17: Mean OGTT Values v/s Maternal Conditions

Maternal Conditions		Mean OGTT	Standard Deviation	ANNOVATest p-Value
VaginalCandidiasis	No	200.98	29.94	p =0.309
	Yes	194.54	28.93	
UTI	No	198.77	28.30	p =0.926
	Yes	198.09	34.21	
Polyhydramnios	No	202.03	26.94	**p = 0.009**
	Yes	180.40	36.85	
PROM	No	197.44	30.49	p =0.289
	Yes	207.55	20.27	
Pre-Eclampsia	No	197.61	29.63	p =0.246
	Yes	211.14	27.92	
Pre-termlabour	No	199.36	30.24	p =0.556
	Yes	194.29	26.02	

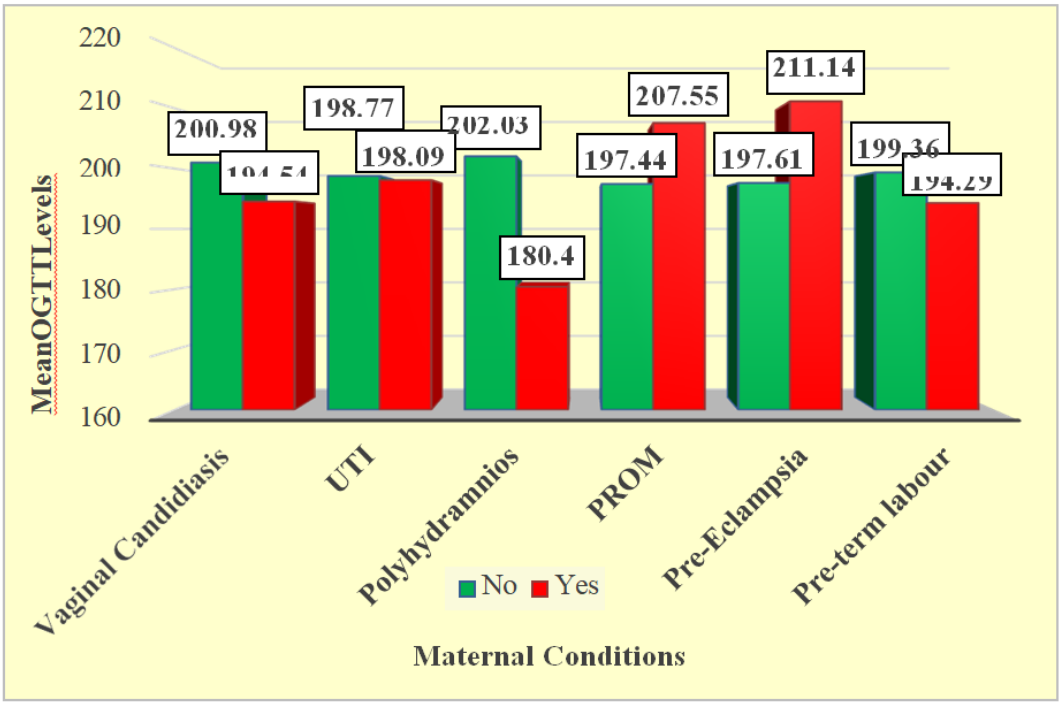

Fig:11 Mean OGTT Values v/s Maternal Conditions

The comparison of mean Oral Glucose Tolerance Test (OGTT) values across various maternal condition sreveals that polyhydramnios showed a statistically significant association with OGTT levels (p = 0.009), with affected individuals having a lower mean OGTT value (180.40mg/dL) compared to those without the condition (202.03mg/dL). This couldindicate a potential glycemic influence on amniotic fluid volume. Other conditions like vaginal candidiasis, UTI, PROM, pre-eclampsia, and pre-term labor did not show statistically significant differences in OGTT values, as their p-values were all above 0.05. While variations in glucose levels exist across conditions, only the link with polyhydramnios reached statistical significance in this sample.

Table18: Mean OGTT Values v/s Fetal Conditions

Fetal Conditions		Mean OGTT	Standard Deviation	ANNOVA Test p-Value
Macrosomia	No	199.39	28.58	p =0.279
	Yes	184.60	46.07	
Hyaline membrane disease	No	199.75	28.89	p =0.302
	Yes	189.91	34.71	
Hyperbilirubinemia	No	197.51	28.79	p =0.265
	Yes	209.11	36.61	

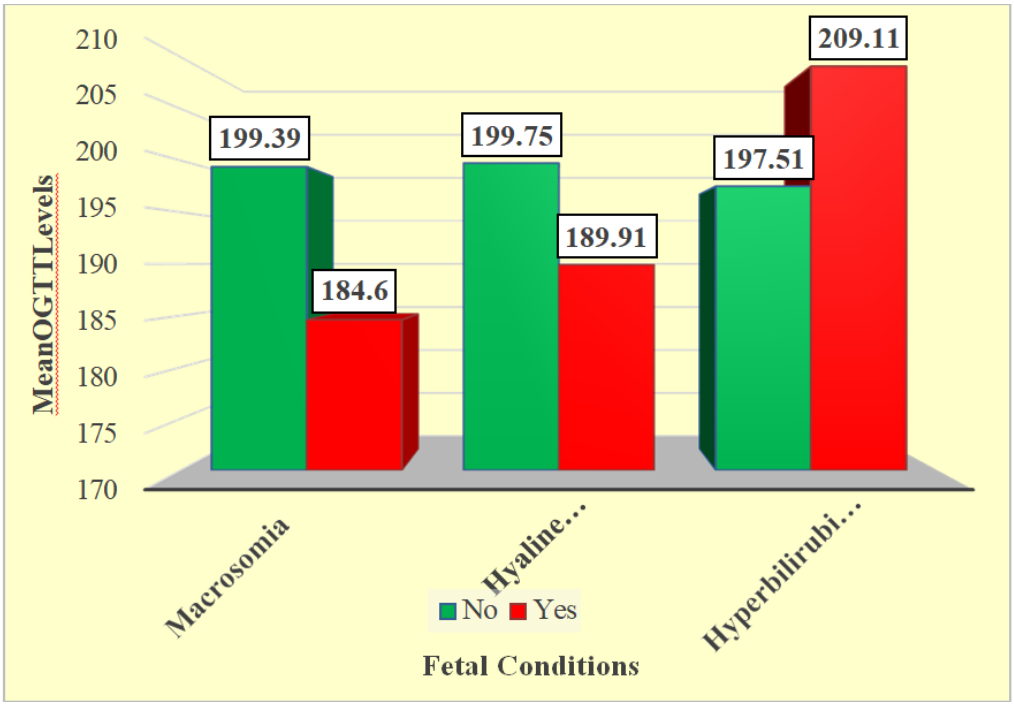

Fig18:Mean OGTT Values v/s Fetal Conditions

The analysis of mean OGTT values in relation to fetal conditions indicates that none of the observed associations were statistically significant, as all p-values are above 0.05. Although variations in glucose tolerance were noted — such as lower OGTT levels in cases of macrosomia (184.60 mg/dL) compared to those without (199.39 mg/dL) and higher OGTT levels in neonates with hyperbilirubinemia (209.11 mg/dL vs 197.51 mg/dL) . These differences did not reach statistical significance.Similarly, for hyalinemembrane disease, the mean OGTT was slightly lower in affected neonates (189.91 mg/dL) compared to unaffected (199.75 mg/dL), but the difference was also not significant (p = 0.302). Overall, while some trends are visible, no strong statistical evidence links OGTT levels to these specific fetal outcomes in this dataset.

CONCLUSION

Diabetes remains a significant disease threatening pregnant women and their offspring. The metabolic characteristics of GDM women are mirrored by OGTT values at diagnosis, but are not associated with adverse pregnancy outcomes. Intensive management and a tailored treatment of GDM improve maternal-neonatal outcomes, regardless of diagnostic values distribution and pre-gestational metabolic characteristics. Women with a history of GD Maswellas of fspring exposed to maternal diabetes in utero should be a major area of focus for preventive medicine. Preventive measures against type2 diabetes mellitus should start during intrauterine period and continue through out life from early childhood. Since the only expenditure involved is a simple screening blood test, it is recommended that all patients be universally screened for GDM.

In conclusion, a short term intensive care gives a long term pay of fin the primary prevention of impaired glucose tolerance, diabetes and obesity in the of fspring, as preventive medicine starts before birth. The maternal health and fetal outcome depends upon the care by the committed team of dialectologists, obstetricians and neonatologists

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