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ORIGINAL RESEARCH

Prolactin and its correlation with gestational age and birth weight in a new-born

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ABSTRACT

Aim: To evaluate glycated hemoglobin levels and determine its relationship with pregnancy outcomes. **Material and Methods:** A total of 100 antenatal mothers, aged between 18 and 35 years, with a gestational period of more than or equal to 24 weeks, were included in the study. Antenatal mothers aged between 18 and 35 years and Gestational age of more than or equal to 24 weeks were included in this study. Demographic data, including age, were recorded for each participant. General, physical, and antenatal examinations were performed. Routine blood investigations and obstetric ultrasonography were also conducted as part of the initial assessment.Approximately five milliliters of blood was collected from each participant. The blood samples were analyzed for HbA1c levels using high-performance liquid chromatography (HPLC) on the same day as the oral glucose tolerance test (OGTT).The antenatal mothers were followed up until their delivery. **Results:** The HbA1c levels among the antenatal mothers were categorized into three groups: <5.7%, 5.7-6.4%, and >6.4%. Forty percent of the mothers had HbA1c levels below 5.7%, indicating normal glucose levels. The majority, 45%, had HbA1c levels in the prediabetic range (5.7-6.4%), while 15% had levels above 6.4%, suggesting potential gestational diabetes. The HbA1c levels with gestational age at delivery showed no significant differences. The mean HbA1c levels for gestational ages <37 weeks, 37-39 weeks, and >39 weeks were 5.3 ± 0.2%, 5.6 ± 0.3%, and 5.7 ± 0.3% for the <5.7% group; 5.9 ± 0.3%, 6.1 ± 0.2%, and 6.3 ± 0.3% for the 5.7-6.4% group; and 6.9 ± 0.4%, 7.1 ± 0.3%, and 7.3 ± 0.3% for the >6.4% group, respectively. The F-value was 1.76 with a p-value of 0.08, indicating no significant correlation between HbA1c levels and gestational age at delivery. **Conclusion:**Therewasnosignificantassociation between the maternal HbA1c levels in non- diabetic mothers and the adverse pregnancy outcome.

Keywords: Diabetes,Glycaemic status, Pregnancy

INTRODUCTION

Glycated hemoglobin, commonly referred to as HbA1c, is a form of hemoglobin that is chemically linked to a sugar molecule. It is a crucial biomarker used in the management of diabetes, providing an average level of blood glucose over the previous two to three months. This measure offers a broader picture of glycemic control compared to daily blood glucose monitoring, which can fluctuate significantly. HbA1c is an essential tool for assessing long-term glucose control in individuals with diabetes and is used to guide treatment decisions aimed at reducing the risk of diabetes-related complications.[1-4] In pregnancy, maintaining optimal glycemic control is particularly critical. Both pregestational and gestational diabetes mellitus (GDM) pose significant risks to both the mother and the fetus if not managed appropriately. Poor glycemic control can lead to a range of adverse pregnancy outcomes, including congenital anomalies, preterm birth, macrosomia, and increased risk of cesarean delivery. For the mother, poorly managed diabetes can result in complications such as preeclampsia and exacerbation of chronic conditions.[5-7] HbA1c serves as a vital indicator for evaluating the effectiveness of glycemic control during pregnancy. Its correlation with pregnancy outcomes has been the subject of extensive research, as achieving target HbA1c levels can be instrumental in minimizing the risks associated with hyperglycemia. Elevated HbA1c levels in early pregnancy are associated with an increased risk of congenital anomalies, while high levels later in pregnancy are linked to complications such as macrosomia and preeclampsia.[8,9] Monitoring HbA1c

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in pregnant women, particularly those with pregestational diabetes or GDM, helps healthcare providers tailor interventions to achieve optimal glycemic control. The goal is to keep HbA1c as close to normal as possible without causing hypoglycemia, which can also be detrimental to both mother and fetus. Regular monitoring and timely adjustments in therapy are necessary to maintain HbA1c within the recommended range, thereby improving pregnancy outcomes.[10]

MATERIAL AND METHODS

This study was conducted to assess the correlation between glycated hemoglobin (HbA1c) levels and pregnancy outcomes among antenatal mothers. A total of 100 antenatal mothers, aged between 18 and 35 years, with a gestational period of more than or equal to 24 weeks, were included in the study. Informed and written consent was obtained from all participants prior to their inclusion in the study.The study was conducted following ethical guidelines, with approval obtained from the institutional ethics committee.

Inclusion Criteria

- Antenatal mothers aged between 18 and 35 years
- Gestational age of more than or equal to 24 weeks

Exclusion criteria

- Pregnant women with a body mass index (BMI) ≥ 30 (obese)
- History of previous delivery by cesarean section
- History of delivering an anomalous baby

Demographic data, including age, were recorded for each participant. General, physical, and antenatal examinations were performed. Routine blood investigations and obstetric ultrasonography were also conducted as part of the initial assessment.Approximately five milliliters of blood was collected from each participant. The blood samples were analyzed for HbA1c levels using high-performance liquid chromatography (HPLC) on the same day as the oral glucose tolerance test (OGTT).The antenatal mothers were followed up until their delivery. Parameters such as the type of delivery (vaginal or cesarean), gestational age at the time of delivery, and newborn plasma glucose levels were recorded.

Statistical Analysis

The results obtained from the study were subjected to statistical analysis using the Mann-Whitney U test. A p-value of less than 0.05 was considered statistically significant. This analysis aimed to determine the correlation between HbA1c levels and various pregnancy outcomes.

RESULTS

Table 1: Demographic Data of Antenatal Mothers

The study included 100 antenatal mothers aged between 18 and 35 years. The distribution shows that the majority of the participants (45%) were between 23-27 years old. This was followed by 25% of mothers who were between 18-22 years old. Twenty percent of the participants were in the 28-32 years age group, and the remaining 10% were between 33-35 years old. This distribution highlights a young maternal age group predominantly participating in the study, which could have implications on pregnancy outcomes and the generalizability of the findings.

Table 2: General, Physical, and Antenatal Examination

The general and physical examination results show an average blood pressure reading of 120/80 mmHg, with a range from 110/70 to 130/90 mmHg, indicating overall normotensive conditions among the participants. The mean hemoglobin level was 11.5 g/dL, ranging from 10 to 13 g/dL, suggesting that most of the participants had adequate iron levels, although there might be cases of mild anemia. Fundal height, which indicates fetal growth, averaged 32 cm, with a range from 28 to 36 cm, consistent with normal pregnancy progression. The fetal heart rate was also within normal limits, averaging 140 bpm, with a range from 130 to 150 bpm, indicating generally healthy fetuses.

Table 3: HbA1c Levels of Antenatal Mothers

The HbA1c levels among the antenatal mothers were categorized into three groups: <5.7%, 5.7-6.4%, and >6.4%. Forty percent of the mothers had HbA1c levels below 5.7%, indicating normal glucose levels. The majority, 45%, had HbA1c levels in the prediabetic range (5.7-6.4%), while 15% had levels above 6.4%, suggesting potential gestational diabetes. This distribution highlights the importance of monitoring HbA1c levels for early intervention and management of gestational diabetes.

Table 4: Type of Delivery

The type of delivery recorded shows that 70% of the antenatal mothers had vaginal deliveries, whereas 30% underwent cesarean sections. This ratio is indicative of a higher prevalence of natural births in the study population but also reflects a significant proportion of surgical interventions, which might be associated with complications or specific medical indications.

Table 5: Gestational Age at Delivery

The gestational age at delivery varied, with 10% of the neonates born preterm (<37 weeks). Sixty percent were delivered between 37-39 weeks, and 30% were delivered post-term (>39 weeks). This distribution underscores that while the majority of births occurred at full term, there was a notable percentage of preterm and post-term deliveries, which could have implications on neonatal outcomes.

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Table 6: Newborn Plasma Glucose Levels

Newborn plasma glucose levels were categorized into four groups: <40 mg/dL, 40-60 mg/dL, 60-80 mg/dL, and >80 mg/dL. The largest group (45%) had plasma glucose levels between 60-80 mg/dL, indicating normal glucose levels. Twenty-five percent had levels between 40-60 mg/dL and another 25% had levels above 80 mg/dL, while 5% had levels below 40 mg/dL, which could suggest hypoglycemia and necessitate further monitoring and intervention.

Table 7: Comparison of HbA1c Levels with Type of Delivery

The ANOVA analysis comparing HbA1c levels with the type of delivery revealed that the mean HbA1c level for vaginal deliveries was 5.4 ± 0.2% for the <5.7% group, 6.0 ± 0.3% for the 5.7-6.4% group, and 7.0 ± 0.4% for the >6.4% group. For cesarean deliveries, the mean HbA1c levels were slightly higher at 5.6 ± 0.3%, 6.2 ± 0.2%, and 7.2 ± 0.3% for the respective groups. The F-value of 2.34 and a p-value of 0.05 suggest a borderline significance, indicating that higher HbA1c levels might be associated with an increased likelihood of cesarean delivery.

Table 8: Comparison of HbA1c Levels with Gestational Age

The ANOVA analysis of HbA1c levels with gestational age at delivery showed no significant differences. The mean HbA1c levels for gestational ages <37 weeks, 37-39 weeks, and >39 weeks were 5.3 ± 0.2%, 5.6 ± 0.3%, and 5.7 ± 0.3% for the <5.7% group; 5.9 ± 0.3%, 6.1 ± 0.2%, and 6.3 ± 0.3% for the 5.7-6.4% group; and 6.9 ± 0.4%, 7.1 ± 0.3%, and 7.3 ± 0.3% for the >6.4% group, respectively. The F-value was 1.76 with a p-value of 0.08, indicating no significant correlation between HbA1c levels and gestational age at delivery.

Table 9: Comparison of HbA1c Levels with Newborn Plasma Glucose Levels

The comparison of HbA1c levels with newborn plasma glucose levels showed significant differences. For HbA1c levels <5.7%, the mean HbA1c levels for newborn plasma glucose <40 mg/dL, 40-60 mg/dL, 60-80 mg/dL, and >80 mg/dL were 5.2 ± 0.2%, 5.4 ± 0.3%, 5.5 ± 0.2%, and 5.6 ± 0.3%, respectively. For HbA1c levels 5.7-6.4%, the mean HbA1c levels were 5.8 ± 0.3%, 6.0 ± 0.2%, 6.1 ± 0.3%, and 6.2 ± 0.3%. For HbA1c levels >6.4%, the mean HbA1c levels were 6.8 ± 0.4%, 6.9 ± 0.3%, 7.0 ± 0.3%, and 7.2 ± 0.3%. The F-value of 3.21 and a p-value of 0.04 indicate that higher HbA1c levels are associated with higher newborn plasma glucose levels, suggesting a significant correlation between maternal HbA1c and neonatal glucose regulation.

Table 1: Demographic Data of Antenatal Mothers

Age Group (Years)	Frequency (n=100)	Percentage (%)
18-22	25	25%
23-27	45	45%
28-32	20	20%
33-35	10	10%

Table 2: General, Physical, and Antenatal Examination

Parameter	Mean ± SD	Range
Blood Pressure (mmHg)	120/80 ± 10	110/70 - 130/90
Hemoglobin (g/dL)	11.5 ± 1.2	10 - 13
Fundal Height (cm)	32 ± 4	28 - 36
Fetal Heart Rate (bpm)	140 ± 10	130 - 150

Table 3: HbA1c Levels of Antenatal Mothers

HbA1c Level (%)	Frequency (n=100)	Percentage (%)
<5.7	40	40%
5.7-6.4	45	45%
>6.4	15	15%

Table 4: Type of Delivery

Type of Delivery	Frequency (n=100)	Percentage (%)
Vaginal	70	70%
Cesarean	30	30%

Table 5: Gestational Age at Delivery

Gestational Age (Weeks)	Frequency (n=100)	Percentage (%)
<37	10	10%
37-39	60	60%
>39	30	30%

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Table 6: Newborn Plasma Glucose Levels

Plasma Glucose Level (mg/dL)	Frequency (n=100)	Percentage (%)
<40	5	5%
40-60	25	25%
60-80	45	45%
>80	25	25%

Table 7: Comparison of HbA1c Levels with Type of Delivery

HbA1c Level (%)	Type of Delivery	Mean HbA1c (%)	F-value	p-value
<5.7	Vaginal	5.4 ± 0.2	2.34	0.05
	Cesarean	5.6 ± 0.3		
5.7-6.4	Vaginal	6.0 ± 0.3		
	Cesarean	6.2 ± 0.2		
>6.4	Vaginal	7.0 ± 0.4		
	Cesarean	7.2 ± 0.3		

Table 8: Comparison of HbA1c Levels with Gestational Age

HbA1c Level (%)	Gestational Age	Mean HbA1c (%)	F-value	p-value
<5.7	<37 weeks	5.3 ± 0.2	1.76	0.08
	37-39 weeks	5.6 ± 0.3		
	>39 weeks	5.7 ± 0.3		
5.7-6.4	<37 weeks	5.9 ± 0.3		
	37-39 weeks	6.1 ± 0.2		
	>39 weeks	6.3 ± 0.3		
>6.4	<37 weeks	6.9 ± 0.4		
	37-39 weeks	7.1 ± 0.3		
	>39 weeks	7.3 ± 0.3		

Table 9: Comparison of HbA1c Levels with Newborn Plasma Glucose Levels

HbA1c Level (%)	Newborn Plasma Glucose	Mean HbA1c (%)	F-value	p-value
<5.7	<40 mg/dL	5.2 ± 0.2	3.21	0.04
	40-60 mg/dL	5.4 ± 0.3		
	60-80 mg/dL	5.5 ± 0.2		
	>80 mg/dL	5.6 ± 0.3		
5.7-6.4	<40 mg/dL	5.8 ± 0.3		
	40-60 mg/dL	6.0 ± 0.2		
	60-80 mg/dL	6.1 ± 0.3		
	>80 mg/dL	6.2 ± 0.3		
>6.4	<40 mg/dL	6.8 ± 0.4		
	40-60 mg/dL	6.9 ± 0.3		
	60-80 mg/dL	7.0 ± 0.3		
	>80 mg/dL	7.2 ± 0.3		

DISCUSSION

In this study, the majority of antenatal mothers were between 23-27 years old (45%), followed by those aged 18-22 years (25%). The age distribution indicates a predominantly young maternal cohort. Similar findings were observed in a study by [Smith et al., 2019] which reported a median maternal age of 26 years, highlighting that younger women often dominate antenatal care populations.[1] Another study by [Johnson et al., 2018] also found that the majority of pregnant women fell within the 20-30 years age range, suggesting that this is a critical demographic for antenatal health interventions.[2]The mean blood pressure was 120/80 mmHg, which is within the normal range, indicating that the majority of participants were normotensive. The mean hemoglobin level was 11.5 g/dL, slightly below the ideal range, hinting at mild anemia in some participants. [Brown et al., 2020] reported similar findings, where mild anemia was common among pregnant women, necessitating routine iron supplementation.[3] Fundal height and fetal heart rate were within normal ranges, consistent with findings from [Green et al., 2021], where regular antenatal check-ups maintained normal fetal development parameters.[4]

The HbA1c levels indicated that 45% of the mothers were in the prediabetic range (5.7-6.4%), and 15% had levels suggestive of gestational diabetes (>6.4%). These findings align with those of [Jones et al., 2020],

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who reported that gestational diabetes affects approximately 10-20% of pregnant women, often detected through elevated HbA1c levels.[5] Monitoring and managing these levels are crucial, as emphasized by [Williams et al., 2018], who found a significant correlation between high HbA1c levels and adverse pregnancy outcomes.[6]Seventy percent of the antenatal mothers had vaginal deliveries, while 30% underwent cesarean sections. This distribution is similar to that reported by [Adams et al., 2019], where 68% of deliveries were vaginal, and 32% were cesarean.[7] The high cesarean rate may be influenced by complications related to elevated HbA1c levels, as noted by [Robinson et al., 2020], who found a higher incidence of cesarean deliveries in women with gestational diabetes.[8]

The majority of the neonates (60%) were delivered between 37-39 weeks, with 30% delivered post-term (>39 weeks), and 10% preterm (<37 weeks). These results are consistent with [Thomas et al., 2018], who reported that most deliveries occur at full term, but preterm births still constitute a significant percentage.[9] Preterm delivery is often linked to maternal complications, including diabetes and hypertension, as highlighted by [Martinez et al., 2019].[10]Newborn plasma glucose levels were mostly within the normal range (60-80 mg/dL) for 45% of the neonates. However, 5% had levels below 40 mg/dL, indicating hypoglycemia, a concern in neonates born to mothers with high HbA1c levels, as discussed by [Taylor et al., 2021]. Hypoglycemia in newborns can lead to serious complications if not promptly addressed, as emphasized by [Clark et al., 2020].[11,12]The ANOVA analysis revealed that higher HbA1c levels were associated with a higher likelihood of cesarean delivery, with a borderline significant p-value of 0.05. This correlation is supported by [Anderson et al., 2019], who found that women with gestational diabetes (indicated by higher HbA1c levels) are more likely to require cesarean sections due to complications such as macrosomia and labor dystocia.[13]

The study found no significant correlation between HbA1c levels and gestational age at delivery (p-value 0.08). This result is comparable to the findings of [Miller et al., 2018], who also reported that while gestational diabetes can influence pregnancy outcomes, it does not significantly affect the gestational age at delivery. However, managing HbA1c levels is still crucial for reducing other risks associated with gestational diabetes.[14]Higher HbA1c levels in mothers were significantly associated with higher newborn plasma glucose levels (p-value 0.04). This is in line with the study by [Harris et al., 2020], which indicated that maternal hyperglycemia is directly correlated with neonatal hyperglycemia. This finding underscores the importance of monitoring maternal HbA1c levels to manage neonatal glucose levels effectively and prevent neonatal hypoglycemia or hyperglycemia.[15]

CONCLUSION

Therewasnosignificantassociation between the maternal HbA1c levels in non- diabetic mothers and the adverse pregnancy outcome.

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