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Pediatrics

ASSOCIATION OF HBA1C AND MACROSOMIA IN INFANTS OF DIABETIC MOTHER IN A TERTIARY MEDICAL CENTRE IN BIHAR: A CROSS SECTIONAL STUDY

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ABSTRACT **Intro:** According to the World Health Organization's Global Report on Diabetes, the approximate prevalence of diabetes in South East Asia is 8.6%, or 96 million people. According to World Health Organization data, India has 69.2 million people with diabetes (8.7%). According to the ICMR-INDIAB report, the prevalence of diabetes in Tamil Nadu is 10.4%, with 7.8% of the rural population and 13.7 percent of the urban population.

Aim and objectives: To study the correlation between HbA1c and macrosomia in infant of diabetic mother. **Material and Methods:** This study is an observational cross sectional type of study done at Mahavir Vatslya Hospital, Patna, Department of Pediatrics during Oct 2020 to March 2021. Newborn babies of mothers who were already diagnosed as diabetic, and delivered in Mahavir Vatslya Hospital Patna on the 230 study subjects, who follow inclusion and exclusion criteria.**Result:** On finding correlation between birth weight of baby and HBA1C of mothers by applying regression analysis we found that there was strong positive correlation with R square 0.703. The mean HBA1C of study subjects who undergone LSCS were 5.08±0.51, whereas those who undergone normal vaginal delivery had mean HBA1C 4.498±0.454. we found there is significant difference between two group, with larger the value of HBA1C there is more chances of LSCS. The mean birth weight of baby whose mothers were on insulin were 3.29±0.44 whereas the mean birth weight of baby whose mothers were on meal plan were 3.35±0.454, on applying t test there was non significant difference between two groups. **Conclusions :** glycosylated haemoglobin (HbA1c) statistically significantly related to the women giving birth to Macrosomic babies. Diabetic pregnant women who have a higher value of HbA1 care definitely more likely to have a macrosomic baby.

KEYWORDS : HBA1C, Diabetes, macrosomia, hyperglycemia

INTRODUCTION

Diabetes mellitus is a disorder whose incidence has risen significantly in recent decades and is expected to rise much further in the near future as obesity and sedentary lifestyles become more common. Its geographical range is diverse. According to the World Health Organization's 2016 global report on diabetes, the number of diabetic adults has nearly quadrupled since 1980, with 422 million adults living with diabetes1. According to the International Diabetes Federation, the number of adults with diabetes will rise to 642 million by 2040 2.

According to the World Health Organization's Global Report on Diabetes, the approximate prevalence of diabetes in South East Asia is 8.6%, or 96 million people.1 According to World Health Organization data3, India has 69.2 million people with diabetes (8.7%). According to the ICMR-INDIAB report, the prevalence of diabetes in Tamil Nadu is 10.4%, with 7.8% of the rural population and 13.7 percent of the urban population4.

Diabetes that is uncontrolled creates a vicious cycle. Diabetes in later life is caused by early imprinting, including the in-utero environment5. Hyperglycemia in the mother causes foetal hyperinsulinemia, which leads to insulin resistance in childhood and decreased glucose tolerance in adulthood6.

When the number of diabetic patients grows, so does the number of pregnancies affected by the disease. Women who are diagnosed with diabetes during pregnancy may have had diabetes before conceiving but were not aware of it. Many women visit the hospital for the first time during their pregnancy in our setting, where people do not go for daily health check-ups. These days, the number of women with pregestational diabetes is on the rise.

THE EFFECT ON PREGNANCY

The degree of glycemic regulation, as well as the degree of underlying disease, affects the pregnancy outcome. Overt diabetes during pregnancy has severe consequences for both the foetus and the mother.

The following are the complications:

Spontaneous Abortion: Diabetes mellitus that is poorly regulated leads to a rise in the number of spontaneous abortions. In a study of 126 women, the weak glucose control group had a nearly 5-fold higher rate of pregnancy loss than the equal glucose control group.

Malformations: Poor glycemic regulation in the mother leads to changes in lipid metabolism, the formation of toxic superoxide radicals, and the activation of programmed cell death. Any of these factors may be to blame for the foetus' malformations.

Preterm Birth: The prevalence of preterm birth in women with diabetes mellitus is 38 percent .Another issue is that antenatal steroids used to prevent preterm birth in diabetic patients cause glycemic control to deteriorate, necessitating an increase in insulin dosage.

Fetal Macrosomia: In pregnancies complicated by gestational diabetes mellitus, the foetus grows too quickly, causing macrosomia. Hyperinsulinemia in the foetus is caused by maternal hyperglycemia, which stimulates excessive growth in the foetus. Infants born to diabetic mothers have higher neonatal fat mass and morphological heart improvements, as well as higher insulin-like growth factor-1 levels in cord blood. Other factors implicated in macrosomia include fibroblast growth factor, epidermal growth factor, platelet dependent growth factor, leptin, and adiponectin. There is an excess of lipid transfer to the developing foetus, which leads to foetal overgrowth.7

Neonatal Hypoglycemia: Neonatal hyperinsulinemia causes hypoglycemia shortly after birth. It's known as a blood glucose level of less than 40 mg/dl in an infant of any gestational age, with or without symptoms. The amount of insulin in the cord blood is proportional to the maternal glycemic level. As a result, mothers with impaired glycemic regulation are more likely to have hypoglycemia in their newborns.

With the above background study was conducted and having following aim and objectives

AIM OF THE STUDY

To study the correlation between HbA1c and macrosomia in infant of diabetic mother.

MATERIAL AND METHODS

This study is an observational cross sectional type of study done at Mahavir Vatslya Hospital, Patna, Department of Pediatrics during Oct 2020 to March 2021. Newborn babies of mothers who were already diagnosed as diabetic, and delivered in Mahavir Vatslya Hospital Patna on the 230 study subjects, who follow inclusion and exclusion criteria.

INCLUSION CRITERIA:

1. Babies born to mothers who are diagnosed as pre gestational

diabetes mellitus and gestational diabetes mellitus.
2. Singleton pregnancy.

EXCLUSION CRITERIA:
1) Newborns born with congenital anamolies.
2) Infants of mothers having any other co-morbid conditions apart from diabetes mellitus.

METHODOLOGY :
Pregnant women who were diagnosed as having overt diabetes or gestational diabetes were invited to take part in the study. This study, done on their newborn babies and them was explained in detail to them. An informed consent was obtained. Pregnant women fulfilling the inclusion criteria were listed. When these mothers delivered, their blood samples were taken to measure HbA1c levels. The women were classified into two categories as having pre-gestational and gestational diabetes mellitus. Their body mass index, weight gain during pregnancy, duration of diabetes mellitus and type of treatment for diabetes were recorded. The newborn's birth order, mode of delivery, gestational age and birth weight were recorded. All this data was then analysed.

RESULT

Table 1: Basic demographic characteristics of study subjects.

Report			
	AGE	BMI	WEIGHT GAIN IN PREGNANCY
Mean	25.50	21.96	11.88
N	230	230	230
SD	2.990	3.000	1.313
Minimum	19	14	8
Maximum	36	28	15

Table 1 shows Basic demographic characteristics of study subjects. The mean age was 25.5±2.99, mean BMI was 21.96±3.0 and weight gain during pregnancy was 11.88±1.31kg.

Table 2: Type of Diabetes in study population

		Frequency	Percent
Valid	GDM	100	43.5
	PGDM	130	56.5
	Total	230	100.0

Table 2 shows type of Diabetes in study population. 56.5 % study subjects had pregestational diabetes whereas only 43.5% study subjects had gestational diabetes.

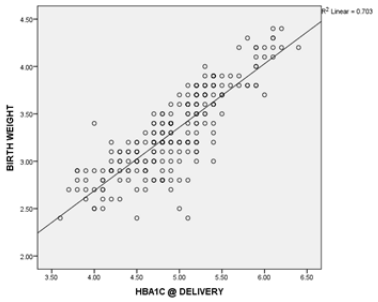

Fig 1: Correlation of HBA1C and Birth weight

Fig 1 shows Correlation of HBA1C and Birth weight. On finding correlation between birth weight of baby and HBA1C of mothers by applying regression analysis we found that there was strong positive correlation with R square 0.703.

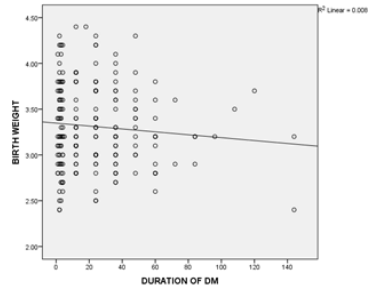

Fig 2: Correlation of Duration of diabetes in mother and Birth weight

Fig 2 shows Correlation of Duration of diabetes in mother and Birth weight. By applying Regression analysis for calculating correlation we found that almost no correlation was found with R square 0.008

Table 3: Mean of HBA1C as per the mode of delivery

Report						
HBA1C @ DELIVERY						
MODE OF DELIVERY	Mean	N	Std. Deviation	Minimum	Maximum	
LSCS	5.0830	171	.51313	3.90	6.40	t- 7.76
NVD	4.4983	59	.45429	3.60	5.40	P Value-
Total	4.9330	230	.55967	3.60	6.40	<0.001

Table 3: Mean of HBA1C as per the mode of delivery. Here we assess the association of mode of delivery with the HBA1C of study subjects. The mean HBA1C of study subjects who undergone LSCS were 5.08±0.51, whereas those who undergone normal vaginal delivery had mean HBA1C 4.498±0.454. On applying t test to assess the statistical significance between two group , we found there is significant difference between two group, with larger the value of HBA1C there is more chances of LSCS.

Table 4: Mean of birth weight of baby as per the mode of treatment of diabetes in mother.

BIRTH WEIGHT						
MODE OF TREATMENT	Mean	N	Std. Deviation	Minimum	Maximum	
insulin	3.2919	148	.44332	2.40	4.40	t-0.98,
meal plan	3.3537	82	.45439	2.40	4.30	P value-
Total	3.3139	230	.44729	2.40	4.40	0.32

Table 4 shows Mean of birth weight of baby as per the mode of treatment of diabetes in mother. The mean birth weight of baby whose mothers were on insulin were 3.29±0.44 whereas the mean birth weight of baby whose mothers were on meal plan were 3.35±0.454, on applying t test there was non significant difference between two groups. We can conclude on this basis that the birth weight of baby does not affected by the type of treatment plan they are following for their management of diabetes.

DISCUSSION

In this study , a total of 230 pregnant women with diabetes mellitus and their newborn babies were included. In this study, there is a statistically significant correlation between glycosylated haemoglobin (HbA1c) at delivery and occurrence of Macrosomia in infants of diabetic mothers. Pregnant diabetic women having a value of HbA1c > 5.6 are more likely to have a macrosomic baby. Glycosylated haemoglobin value measured at the time of delivery is a good indicator of delivering a macrosomic baby. HbA1c value at delivery reflects the 24 hour glucose profile during the last 6-8 weeks. As the major weight gain in the fetus occurs in the last trimester of pregnancy.

In our present study the mean age was 25.5±2.99, mean BMI was 21.96±3.0 and weight gain during pregnancy was 11.88±1.31kg. In the study by Niranjan Thomas et al8 the mean age of study subjects were 29.38 ± 4.1, study by Balaji et al9 shows Mean age of these women was 26.1 ± 3.9 years, BMI was 24.5 ± 4.8 kg/m2. These findings is almost in accordance with our study. It is in contrast to the study published by N.E. Stotland et al10 where they found that birth macrosomiawas statistically significantly seen in women of age group: 30yrs-40yrs(p<0.001). Thus we can say that Body Mass Index also contributes to having a macrosomic baby in a diabetic women. This is similar to the findings by I.O. Frederick et al11 that body mass index was independently and positively associated with baby's birth weight (p<0.001). Study by Mehrnaz Valadan12 There were no statistically significant correlations for third trimester HbA1c. Maternal weigh gain during pregnancy had significant positive relationship with birth weight In our present study 56.5 % study subjects had pregestational diabetes whereas only 43.5% study subjects had gestational diabetes. Study by Balaji et al9 shows GDM was identified in 195 women (n = 33 in the first trimester and n = 162 in the 2nd/3rd trimester) out of 1459 subjects.. Women with GDM were significantly older and had higher BMI at booking, higher HbA1c at booking, greater history of previous GDM, and greater family history of type 2 diabetes than women without GDM.

The variation of the incidence of gestational diabetes in different study was due to difference in study design and study settings. In the present

study On finding correlation between birth weight of baby and HBA1C of mothers by applying regression analysis we found that there was strong positive correlation with R square 0.703.

Cord blood HbA1c correlated with birth weight. The mean cord blood HbA1c in macrosomic babies was 6.2% ± 0.6% as compared to 4.7% ± 0.5% in nonmacrosomic babies. Mahapatra and Raj13 in their study showed that cord blood HbA1c >6.5 helped in predicting macrosomia. On the other hand, Sosenko et al. showed no correlation between cord blood HbA1c and birth weight. Study by Katarzania et al14 shows The most important difference between the macrosomia and non-macrosomia groups was observed for HbA1c, especially in the 2nd and 3rd trimesters: 6.0 % (42 mmol/mol) vs. 5.6 % (38 mmol/mol), $p < 0.001$ and 6.0 % (42 mmol/ mol) vs. 5.5 % (37 mmol/mol), $p < 0.001$, respectively. Similarly, we observed differences in the 2nd and 3rd trimester (but not the 1st trimester) in mean self-monitored glucose: 6.0 vs. 5.6 mmol/l ($p < 0.001$) and 5.9 vs. 5.7 mmol/l ($p = 0.001$). The strongest predictor of birth weight was HbA1c recorded in the 3rd trimester. Its 1 percentage point increase was associated with a 1.68-fold increase in odds of macrosomia ($p = 0.001$). Independently from HbA1c, the level of mean fasting glucose (measured with personal glucose meter) in the 3rd trimester was associated with a 1.38-fold increase in odds of macrosomia (per 1 mmol/l increase, $p = 0.005$).

In the present study Correlation of Duration of diabetes in mother and Birth weight. By applying Regression analysis for calculating correlation we found that almost no correlation was found with R square 0.008. In present study The mean HBA1C of study subjects who undergone LSCS were 5.08±0.51, whereas those who undergone normal vaginal delivery had mean HBA1C 4.498±0.454. On applying t test to assess the statistical significance between two group, study by Buhary MB et al15 found there is significant difference between two group, with larger the value of HBA1C there is more chances of LSCS. Study by patients with HbA1c >6.5% had significantly shorter gestational period with higher CS rates and significantly more miscarriages. Their neonates had significantly more macrosomia and hypoglycemia.

In current study The mean birth weight of baby whose mothers were on insulin were 3.29±0.44 whereas the mean birth weight of baby whose mothers were on meal plan were 3.35±0.454, on applying t test there was non-significant difference between two groups. We can conclude on this basis that the birth weight of baby does not affected by the type of treatment plan they are following for their management of diabetes.

There is growing data to suggest that HbA1c can be used for predicting adverse pregnancy outcomes in women with GDM. Lowe et al.16 and Capula et al.17 have shown that higher HbA1c levels are significantly associated with primary and secondary outcomes studied under HAPO study. We found that pregnant women with HbA1c of ≥5.0% (≥31 mmol/mol) were significantly older and had higher BMI and higher previous history of GDM. These characteristics have been related to adverse pregnancy outcomes for both mother and baby. This is confirmed in our study as women with HbA1c ≥5.0% (≥31 mmol/mol) were at a higher risk of delivering macrosomic babies. However, other pregnancy outcomes did not statistically differ in women who had HbA1c cut points below this level.

CONCLUSIONS

Overall, this study suggests that glycosylated haemoglobin (HbA1c) statistically significantly related to the women giving birth to Macrosomic babies. Diabetic pregnant women who have a higher value of HbA1 care definitely more likely to have a macrosomic baby.

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