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RESEARCH ARTICLE

CORRELATION OF HIGHER MATERNAL BLOOD SUGAR LEVELS WITH NEONATAL BIRTH WEIGHT IN NON-DIABETIC PREGNANT MOTHERS.

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Abstract

Fetus and placenta depend on unique physiologic systems to provide an environment supporting fetal growth and development in preparation for transition to extra-uterine life.

Fetal growth depends on the maternal nutritional status. Glucose is the principal energy substrate for the placenta and the fetus. It is an essential requirement for normal fetal metabolism and growth. Glucose supply is derived via maternal carbohydrate metabolism and gluconeogenesis of amino acids.

Pregnant women with blood sugar levels in the higher range of normal are more likely to give birth to healthier babies.^[1,2]

This study was conducted to correlate maternal OGCT values done thrice in the course of the pregnancy with fetal outcome in the form of birth weight. 300 antenatal patients were followed till delivery. It was observed that an increased maternal blood sugar level, within the normal range, was related to increased Neonatal Birth Weight in healthy mothers.

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Introduction:-

Fetal growth depends on the maternal nutritional status. The fetus utilizes nutrients for two primary purposes: oxidation for energy and tissue accretion. For appropriate fetal growth there is need of adequate amount of glucose, amino acids, fatty acids and vitamins.

Glucose is the principal energy substrate for the placenta and the fetus. It is an essential requirement for normal fetal metabolism and growth. Glucose supply is derived via maternal carbohydrate metabolism and gluconeogenesis of amino acids. The main regulators of glucose transport between the mother and the fetus are glucose transporter proteins in the placenta. These transporters, members of the GLUT gene family of facilitated-diffusion transporters, are embedded in the microvillus (maternal-facing) and basal (fetal-facing) membranes of the syncytiotrophoblast, the main placental barrier layer. However, only GLUT-1 protein has been identified in the syncytium. GLUT-1 is up-regulated during gestation, increased in diabetic pregnancy and decreased in chronic hypoxia leading to IUGR.^[3,4]

Saleh J et al. investigated the association of maternal parameters of healthy non-diabetic mothers with Neonatal Birth Weight of their "appropriate-for-gestational age" neonates. Post-load glucose levels were significantly higher in mothers of heavier neonates. ANOVA results indicated that 15% increase in post-load glucose levels corresponded to more than 0.5 Kg increase in neonatal birth weight (NBW) in the third percentile. This study highlighted that increased maternal post-load sugar levels and blood pressure, within the normal range, highly predicts NBW of healthy mothers. These findings may provide focus for early dietary intervention measures to avoid future risks to the mother and baby^[5].

The present study was conducted with the aim of co-relating the maternal blood sugar levels with weight of newborns in normoglycemic pregnant mothers.

Material and methods:-

A hospital based observational study of 300 antenatal patients was conducted at Bharati Hospital, Pune over a period of 2 years. OGCT values were done thrice during pregnancy: 1st at 14-16 weeks, 2nd at 22-28 weeks, 3rd at 32-34 weeks. The subjects were then categorised according to OGCT values into 2 groups: 70-95mg/dl and 96-120mg/dl. Patients were then followed till delivery to know the pregnancy outcome and birth weight of babies. Qualitative data was presented as frequency and percentage and analyzed using chi-square test. P-value of < 0.05 was considered as significant.

Observation and results:-

Table 1: Distribution based on Oral Glucose Challenge Test (OGCT)

OGCT (mg%)	Mean	SD	p- value
14-16 weeks	86.51	12.47	< 0.01
22-28 weeks	95.23	12.09	
32-34 weeks	93.52	14.80	0.42

Mean Oral Glucose Challenge Test (OGCT) values increased significantly between 14-16 weeks and 22-28 weeks (86.5 vs 95.2 mg%; $p < 0.05$) but stabilizes thereafter at 32-34 weeks ($p > 0.05$).

Table 2: Comparison of Birth weight based on OGCT group

Variable	OGCT Group	N	Mean	SD	p- value
Birth Weight (Kg)	70-95 mg%	194	2.75	0.24	< 0.01
	96-120 mg%	106	3.05	0.35	

Mean weight of babies of high normal OGCT group was significantly more compared to low normal group (3.05 vs 2.75 Kg; $p < 0.05$).

Table 3: Co-relation between birth weight and OGCT values

Pearson's Co-relation	r- value	p-value
Mean OGCT Vs Birth Weight	0.3	< 0.05

A significant positive co-relation was observed between birth weight and blood sugar levels of mother ($r=0.3$; $p < 0.05$).

Table 4. Comparison of Anthropometric parameters of Mothers based on OGCT group

Variable	OGCT Group	N	Mean	SD	p- value
Mean Age (years)	70-95 mg%	194	24.20	3.39	0.15
	96-120 mg%	106	22.90	3.11	
Height (cm)	70-95 mg%	194	156.48	7.19	< 0.05
	96-120 mg%	106	151.95	6.41	
Weight (Kg)	70-95 mg%	194	52.70	10.11	0.96
	96-120 mg%	106	52.84	9.56	
BMI (Kg/m ²)	70-95 mg%	194	21.50	3.52	0.17
	96-120 mg%	106	22.83	3.50	

No significant difference was observed between Mean age, weight and BMI between OGCT groups. However mean height of mothers of low normal OGCT group was significantly more.

Discussion and conclusion:-

We observed that mean weight of babies of high normal OGCT group was significantly more compared to low normal group (3.05 vs 2.75 Kg; $p < 0.05$). A significant positive co-relation was observed between birth weight and blood sugar levels of mother ($r=0.3$; $p < 0.05$).

The positive association between blood glucose and the risk of delivering large for gestational age (LGA) neonates was a common observation in several studies without adjustment for covariates^[6-9].

As the 75 g OGCT can be regarded as a surrogate marker of meal postprandial glycaemia^[10], the findings of this study agree with previous findings in that mild elevations in glucose tolerance, or mild dietary glucose elevations within the normal range, may result in increased fetal growth^[11]. Patel VN et al. conducted a study on 93 pregnant women to monitor longitudinal changes in blood glucose levels in pregnancy and to co-relate it with various maternal and fetal outcomes. They observed that maternal postprandial blood glucose levels affect the birth weight of the baby and also mode of delivery^[12].

This study highlights that increases in maternal post-load sugar levels, within the normal range, highly predict the outcome of Neonatal Birth Weight in AGA neonates. This is particularly apparent in the results showing that increases in post-load glucose levels determine increases in Neonatal Birth Weight in the absence of maternal diabetes. The findings of this study support that estimation of maternal PP2 Blood Glucose levels (OGCT) should be carried out in all pregnant women at the first antenatal visit and at least once in every trimester. This would help to reduce adverse perinatal outcomes

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