

A STUDY OF GLUCOSE CONTENTS IN MATERNAL AND NEONATAL BLOOD IN NORMAL PREGNANCY AND IN TOXAEMIAS OF PREGNANCY*

by

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Introduction

Pregnancy is a condition where the system is in urgent need of the various utilisable materials in which carbohydrate is an important constituent not only for the upkeep of the normal function of the pregnant woman but also for the growing foetus in the uterus. As the blood and body fluids carry this food stuff, its content can be ascertained by the estimation of glucose both in mother and newborn baby so as to find out relationship of this material with normal and toxæmic pregnancy.

Survey of the literature (Dieckmann, 1952; Hobson, 1948; Johnson and Bonsnes, 1948; Mukherjee, 1952; Widen, 1950) clearly points out the derangement in carbohydrate metabolism of the body in pregnancy, but literature is inadequate regarding the glucose contents in the foetal blood in normal and toxæmic pregnancies.

Mukherjee (1952) reported that the rate of utilisation of glucose in normal pregnancy was slightly less than that in the non-pregnant subject, whereas in pre-eclampsia and eclampsia the sugar utilisation was found to be adversely affected.

Hellmuth (1927) observed that pregnant toxæmic women showed no change in their blood sugar level which would differentiate them from normal pregnant women.

Standar *et al* (1946) and Novak and Lustig (1928) observed no change in the blood sugar level in normal and toxæmic pregnancy from the non-pregnant state.

Widen (1950) observed the rise of blood sugar level in eclampsia and opined that this rise might be due to an after effect of convulsions.

Hess (1932) observed the blood sugar level in the foetal blood at term to be lower than that in the mother's blood.

Hertig (1945) noted that the sugar content of the blood of newborn baby had been found to be approximately the same as that of the mother. He observed the average blood sugar level of pregnant women to be 100.5 mg. per 100 ml. of blood and that for the newborn babies 95.4 mg. per cent.

Material and Method

The present study consists of investigation of 100 pregnant women out of which 50 belonged to normal pregnancy, 20 to mild pre-eclampsia, 20 to severe pre-eclampsia and 10 to eclampsia groups. All these cases were selected from the Department of Obstetrics and Gynaecology, Medical College, Calcutta during the period from 1974 to 1976. Blood was

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collected simultaneously from the maternal end of the severed umbilical cord as soon after the birth of the baby as possible and also from the mother. Blood sugar was determined by the modified Schaffer-Hartman method of King (1937, 1942). This method might be taken to give values of true glucose content of blood, whereas Folin-Wo method was found to give higher values.

Results

Analysis of the results of blood sugar in maternal and cord blood in normal and toxæmic pregnancies are given in Tables I to IV.

Analysis of Data

It was observed that sugar contents in mg. per 100 ml. of maternal blood and cord blood in normal pregnancy immediately after confinement were 105.06 ± 0.7453 and 70.00 ± 0.3385 respectively. The difference in sugar content of maternal and foetal blood was highly significant in statistical analysis.

In mild and severe pre-eclampsia the estimation of sugar content of maternal blood showed 101.25 ± 0.8272 and 99.55 ± 0.4892 respectively. In eclampsia the value for sugar content in maternal blood was 98.5 ± 0.5821 . In all three varieties of toxæmia of pregnancy, the alterations in sugar content in maternal blood were statistically significant.

In case of foetal blood in mild and severe pre-eclampsia and in eclampsia the estimation of sugar content immediately after birth showed 73.20 ± 0.5138 , 74.45 ± 0.6198 and 73.9 ± 1.2428 respectively.

The alterations in sugar content of foetal blood has been found to be statistically highly significant.

Sugar Content of Maternal and Foetal Blood Immediately After Confinement

TABLE I

	Mg. per 100 c.c.	
	Mean	Standard error
<i>Normal Pregnancy:</i>		
Maternal blood	105.06	0.7453
Foetal blood	79.00	0.3385
Difference between means	26.06	
't'	38.112	(Highly significant)

TABLE II

	Mg. per 100 c.c.	
	Mean	Standard error
<i>Toxaemic Pregnancy:</i>		
<i>Mild Pre-Eclampsia:</i>		
Maternal blood	101.25	0.8272
Foetal blood	73.20	0.5138
Difference between means	28.05	
't'	43.094	(Highly significant)

TABLE III

	Mg. per 100 c.c.	
	Mean	Standard error
<i>Severe Pre-Eclampsia:</i>		
Maternal blood	99.55	0.4892
Foetal blood	74.45	0.6198
Difference between means	25.10	
't'	42.459	(Highly significant)

TABLE IV

	Mg. per 100 c.c.	
	Mean	Standard error
<i>Eclampsia:</i>		
Maternal blood	98.5	0.5821
Foetal blood	73.9	1.2428
Difference between means	24.6	
't'	19.838	(Highly significant)

Discussion

The analysis of the findings of the glucose level in blood in normal pregnancy shows more or less normal fasting blood sugar level as compared with that of non-pregnant women, whereas blood sugar level in pre-eclampsia and eclampsia reveals significant decrease. This decrease may possibly be due to the faulty utilisation of glucose in these conditions as a result of hormonal imbalance. The reported significant lowered blood sugar values in foetal blood in comparison to maternal blood in toxæmic pregnancies reflects either on the increased demand for the growing tissues of the foetus or hindrance to the passage across the placenta.

Glucose is one of the most easily assimilable substances giving energy for the maintenance of temperature and is absolutely necessary for the purpose of growth. Hence, it is no wonder that the cord-blood glucose level will be less in comparison to that in maternal blood. The regulating mechanism of blood sugar level is also not in work in the foetal body as evident from the available data.

Although glucose passes from the mother to the foetus across the placenta, this does not occur by easy diffusion. The concentration in the foetal blood at term has been found to be lower than that in the mother's blood. It is probable that the foetus has two sources of available carbohydrate: (i) That which crosses over from the maternal blood and (ii) a portion coming from the glycogen deposition in the placenta itself. During the first half of pregnancy the placenta has been found to contain increased shortage of glycogen, whereas with the increase of gestational age, the store of glycogen in placenta gradually diminishes. On this assumption the lower blood sugar level just at birth

can be explained by the reported significant decreased values in babies born of toxæmic mothers than the normal babies pointing to the disturbances in the blood sugar regulatory mechanism. Possibly the liver functions are altered in premature babies and so the system tries to maintain in a vain attempt the integrity of the liver cells by conversion of glucose to glycogen. While glucose is trying to maintain the demands of the hepatic cells, the requirements of the other tissues specially on the nervous system are markedly impaired. This may result in hypoglycaemic convulsion leading to foetal death, so commonly observed in toxæmia of pregnancy.

The significant reduction of blood glucose in new born babies may also be due to the increased utilisation of glucose by the cells of the newborn at the time of parturition, but it is expected that parturition is associated with energy condition where glycogenolysis should be an important mechanism leading to rise in the glucose level. This again points to the hormonal derangement not acting in accordance with the Cori's cycle. Whatever may be the cause of this lower glucose level in the newborn babies the explanations offered require further study and the significant diminution of cord blood glucose level reflects on the increased incidence of prematurity of the newborn of toxæmic mothers.

In conclusion, it has been revealed that the foetus depends on the supply of carbohydrate from the mother and in toxæmias of pregnancy, the carbohydrate metabolism is grossly disturbed resulting in birth of premature babies.

Summary

Analysis of blood glucose contents has been made in maternal and neonatal blood

immediately after confinement in normal and toxæmic pregnancy.

Analysis clearly elucidated significant decrease of the glucose values in toxæmias of pregnancy having close relationship with the severity of the disease.

Explanations have been offered to justify alteration, if any, in the glucose level of maternal and foetal blood and attempts have been made to correlate those with the higher incidence of prematurity among the babies born of toxæmic mothers.

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