



## ASSOCIATION OF NEONATAL BIRTH WEIGHT & PONDERAL INDEX WITH MATERNAL & CORD BLOOD TSH

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### ABSTRACT

**Introduction-** Thyroid hormone regulates fetal growth and development throughout gestation. The placental transfer of maternal thyroid hormone is a major factor in the availability of fetal thyroid hormone. Ponderal Index (PI) is one of the anthropometric methods used to diagnose impaired fetal growth. PI is low in malnourished infants and high in obese ones. The purpose of this study was to examine the association of birth weight of newborn and Ponderal index with maternal and cord blood TSH levels. **Material and Method-** The study was conducted on 100 postpartum females fulfilling the inclusion criteria and their neonates enrolled in Zanana Hospital attached to S.M.S. Hospital, Jaipur. After obtaining their informed written consent, detailed history was taken and blood sample was drawn, Cord Blood samples were also taken. Birth weight and ponderal Index of newborn were assessed. TSH was analysed and data was evaluated statistically. **Result and Discussion:** A significant positive correlation was observed between maternal and cord blood TSH levels. A negative correlation was observed between maternal TSH & Cord blood TSH levels with birth weight and ponderal index of newborns though it was statistically non-significant. **Conclusion-** For healthy weight babies proper antenatal screening of mothers for thyroid function should be done.

**KEYWORDS :** neonates, birth weight, Ponderal index, hypothyroidism.

### INTRODUCTION

A fetus's birth weight is a crucial indicator of its growth, development, diet, and other prenatal exposures. Being short for gestational age (SGA) or having a low birth weight are important risk factors for neonatal mortality and morbidity. They also raise the chance of developing non-communicable diseases later in life(1). Thyroid hormone regulates fetal growth and development throughout gestation. Particularly in the first 18–20 weeks of pregnancy, the placental transfer of maternal thyroid hormone is a major factor in the availability of fetal thyroid hormone. 0.2% to 1% of pregnancies have overt maternal thyroid disorder, such as hypothyroidism or (pre-existing) Graves hyperthyroidism, which are well-known risk factors for low birth weight or SGA. Throughout gestation, thyroid hormone controls a variety of metabolic and anabolic processes in the mother and baby(2). It regulates fetal glucose and oxygen consumption, placentation, metabolism, and other co-factors that directly impact accretion, tissue differentiation, and skeletal growth to control fetal growth (1). Thyroid disorder affects 2.3–3.8% of expectant mothers (3). The commonest thyroid disorder in pregnancy is maternal hypothyroidism [4].

Ponderal Index (PI) is one of the anthropometric methods used to diagnose impaired fetal growth. PI is low in malnourished infants and high in obese ones(5). Ponderal Index should be used for neonates instead of birth weight, although there is little difference between the two measures in predicting neonatal morbidity(6).

Thyroid hormone is essential for children's healthy growth and development, particularly during the first two years of life. Various maternal and perinatal factors are known to affect the Cord blood TSH levels [7].

Therefore, the purpose of this study was to examine the association of birth weight of newborn and Ponderal index with maternal and cord blood TSH levels.

### MATERIALS & METHODS

The present descriptive cross sectional study was conducted in the Department of Biochemistry, SMS Medical College, Jaipur in collaboration with Department of Obstetrics & Gynaecology, SMS Hospital, Jaipur. The study was conducted on 100 postpartum females fulfilling the inclusion criteria and their neonates enrolled in Zanana Hospital attached to S.M.S. Hospital, Jaipur. Pregnant females in active labor were approached & were explained about nature & purpose of the study.

After obtaining their informed written consent, detailed history was taken and blood sample was drawn. Cord Blood samples were also taken after the delivery with all due permissions as per ICMR guidelines and newborns were followed after baseline evaluation by paediatrician. All relevant data generated through history, blood investigations, antenatal card & admission tickets of mother and newborn were recorded in a pre-designed semi-structured study performa & routine and specific investigations were performed using standard criteria. The neonates with major life-threatening malformations & any comorbid conditions & Multiple deliveries (Twin/triplets, etc.) were excluded.

### Calculation Of Ponderal Index

In addition to birth weight, birth length is the most important anthropometric measurement in neonates. The curves of fetal weight and fetal length according to the weeks of gestation differ in their dynamics.

Ponderal Index (PI) or Corpulence Index or Rohrer's Index) is a measure of corpulence, or of leanness in other variants, of a person calculated as a relationship between mass and height. It was first proposed in 1921 as the "Corpulence measure" by Swiss physician Fritz Rohrer and hence is also known as Rohrer's Index(8).

In ponderal index (PI), the neonatal weight and length are inter-related.

Ponderal Index of infant = 100x Weight (grams) / Height<sup>3</sup> (cm)  
 Normal range of PI for infants is 2.2 to 3.0.

Neonates can be symmetrical or asymmetrical according to PI. Symmetrical fetal development includes an appropriate relationship between fetal weight and fetal length. The neonates with low PI are of asymmetrical constitution, i.e. they have a relatively greater length than weight, which is considered a measure of leanness. Asymmetrical neonates with high PI have a relatively greater weight than length, which is taken as a measure of obesity(9).

**Estimation Of Routine & Specific Investigations**

Serum separated from the Cord Blood samples of all the babies born & maternal blood samples were collected & sent for routine biochemical investigations . Serum TSH was analysed using chemiluminescence on fully autoanalyzer Siemens ADVIA CENTAUR XPT.

All data thus procured was entered in Microsoft Excel sheet and master-chart was prepared for statistical analysis. Variables were summarized as mean & standard deviation and were analysed by using unpaired t-test and Pearson correlation coefficient. P value < 0.05 was taken as significant. IBM SPSS 23.0 version software was used for statistical analysis.

**Table-1: Maternal TSH & Cord Blood TSH**

TSH (µIU/ml)	N	Maternal TSH (Mean±Std. Deviation)	Cord Blood TSH (Mean±Std. Deviation)
100		3.99±5.40	3.10±4.93
100		7.24±11.06	8.07±11.53

**Table-2 Correlation Between Maternal TSH & Cord Blood TSH**

Maternal TSH (µIU/ml)	Pearson Correlation	Cord blood TSH
		.936**
	Sig. (2-tailed)	.000
	N	100

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table-3: Birth Weight & Ponderal Index of Newborns**

	Mean	Std. Deviation	N
PONDERAL INDEX	2.36	0.46	100
WEIGHT OF NEW BORN (KG)	2.71	0.53	100

**Table-4: Correlation of Maternal TSH & Cord Blood TSH with Birth Weight Of Newborns**

Birth Weight of Newborns	Pearson Correlation	Maternal TSH	Cord Blood TSH
		-.133	-.143
	Sig. (2-tailed)	.187	.156
	N	100	100

**Table-5: Correlation of Maternal TSH & Cord Blood TSH with Ponderal Index Of Newborns**

Ponderal Index of Newborns	Pearson Correlation	Maternal TSH	Cord Blood TSH
		-.124	-.124
	Sig. (2-tailed)	.217	.217
	N	100	100

**RESULTS & DISCUSSION**

The study was conducted on 100 postpartum females & their newborns. Out of which, 61% newborns were males and 39% were females. Maternal and cord blood TSH were evaluated(table 1).

Birth weight and ponderal Index of newborn were assessed (table 2).

A significant positive correlation was observed between

maternal and cord blood TSH levels(table 3).

A negative correlation was observed between maternal TSH & Cord blood TSH levels with birth weight of newborns though it was statistically non-significant(table 4).

Further also a negative correlation between maternal TSH & Cord blood TSH levels with ponderal index of newborns however it was statistically non-significant.

Newborns whose mothers were diagnosed with thyroid dysfunction prior to, during, or following pregnancy were more likely to experience preterm delivery, deviate from the average birth weight, and have birth weight that was inappropriate for their gestational age. Throughout pregnancy, thyroid hormone controls a variety of metabolic and anabolic processes in the mother and baby. In addition to directly influencing skeletal growth, tissue differentiation, and accretion, it facilitates placentation, regulates metabolism, fetal glucose and oxygen intake, and interacts with other factors to influence fetal growth (10).

Normal early development can be disrupted by maternal thyroid dysfunction, which can cause lower or higher than normal (maternal) Thyroid Hormone levels and transfer to the embryo/fetus. Maternal thyroid dysfunction is the main cause of low or high maternal plasma Thyroid Hormone concentrations. This can be attributed to lower or higher than normal transplacental Thyroid Hormone transport and, consequently, lower or higher than normal embryonic/early fetal Thyroid Hormone levels (11).

**CONCLUSION**

Maternal hypothyroidism affects birth weight of newborn. Hence proper antenatal screening of mothers for thyroid function should be done routinely so that timely issues are addressed to have healthy normal weight babies.

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