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Original Research Article

Relationship between Serum Iron of Pregnant Mother with the Birth Weight of Newborn

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Abstract:
Background: Term small for gestational age (SGA) babies are at risk for developing iron deficiency anemia. The association between maternal and infant iron stores is not clear
Objectives: Our study aimed to explore the association between maternal serum iron level and newborn birth weight (BW) in our tertiary care hospital
Methods: Prospective observational study conducted in the pediatrics department in GMH rewa from April 2020 to March 2021. Total 100 full term mothers were enrolled in this study. Basic demographics features of mothers, serum iron profile and neonatal birth weight was measured.
Results: Out of total 100 pregnant women, most of them (85%) were 20-30 years age group, 68% belong to rural area. Pre Pregnant Weight was 46 – 50 kg in 36% followed by 51-55 kg in 24%. Out of 100 neonates, 59 (59%) were male and 50% of neonates weight range 2.5-3.89 kg. Positive correlation was found between Neonatal birth weight and serum iron levels, which was statistically significant 2nd trimester ($p<0.05$) whereas not significant in 3rd trimester ($p>0.05$).
Conclusion: Potential benefit of IFA supplementation and detection of their deficiencies can contribute to simple low-cost interventions for reducing the incidence of LBW, SGA and IUGR.
Keywords: IFA Supplementation, Neonatal Birth Weight, Serum Iron Level, SGA, Neonates.

Introduction

Iron is an essential nutrient during all stages of human development. The requirement of iron increases during periods of rapid growth and differentiation such as pregnancy and infancy [1]. Iron is one of the essential elements for early brain growth and function; it is involved in appropriate white matter myelination, neurotransmitter synthesis, synaptogenesis, and cellular function such as intracellular signaling pathways and neuronal energy metabolism, including synthesis of cytochromes and adenosine triphosphate formation [2].

The neonatal brain in human is relatively larger than other animals, has a higher metabolic rate, and develops continuously over the fetal period and early infancy [3, 4]. Therefore, this micronutrient deficiency during this critical period may cause adverse consequences in neurodevelopmental outcome. Iron deficiency at birth is more common among high-risk groups, such as infants with low birth weight compared to gestational age, premature infants with very low birth weight, infants of diabetic mothers, and infants of mothers who smoke [5, 6]. Clinical signs of iron deficiency anemia include paleness, irritability, premature fatigue, muscle weakness, increased heart and respiration rate, enlarged heart and spleen, and decreased alertness, and can slow the child's normal growth and development. Therefore, timely diagnosis and treatment of iron deficiency are very important, especially in infants and children [7, 8].

Although there have been slight reductions in the prevalence of anemia in pregnant women, the latest estimates indicate that globally 36% of all pregnant women aged 15–49 years still experience anemia (this value ranges from a mean of 17.2% [12.7–22.8] in high-income countries to 42.6% [39.1–46.0] in low-income countries) [9]. Iron deficiency (ID) is estimated to contribute to 40% of worldwide anemias during pregnancy The WHO recommends that pregnant women should take daily oral iron (30 mg to 60 mg) and folic acid (0.4 mg) supplements to avoid maternal anemia, preterm delivery, and low birth weight [10]. Iron is an essential component of hemoglobin and myoglobin, accounting for approximately 60% of the body's iron. The iron requirement triples during pregnancy due to the growth of the fetoplacental units and the increase in the number of maternal red blood cells [11].

During pregnancy, iron requirement progressively increases until the 1st trimester, in parallel deposition in fetal tissues. Inadequate intakes or deficiency in pregnancy may affect growth and development of the fetus and increase the risk of preterm delivery, LBW and postpartum haemorrhages (PPH) [12]. On the other side, an excessively iron intake may leads women to oxidative stress, impaired glucose metabolism, lipid peroxidation and gestational hypertension.

Aims & Objectives: To assess correlation between serum iron profile and birth weight of neonates.

Materials and Methods

This prospective observational study was carried out in the neonatology unit of Departments of Pediatrics in collaboration with the obstetrics and Gynecology in the GMH Rewa MP from April 2020 to March 2021 after obtaining ethical clearance from institutional ethical committee. Verbal consent was taken from mothers at the time of screening for fetal growth restriction. Written informed consent was taken from the parent/guardian for participation in the study before enrolment. Pregnant women admitted for delivery in the labor room were screened for suspected fetal growth restriction (FGR) by assessing symphysiofundal height and abdominal circumference on available antenatal ultra-sound scans by obstetrician

Inclusion Criteria:

1. The mothers at gestational age of 37- 42 weeks
2. Follows routine visit at 2nd & 3rd trimester of pregnancy in ANC clinic
3. Who delivered in labor room GMH Rewa and any peripheral health care labor room
4. Pregnant women provide written informed consent for the study.

Exclusion Criteria:

1. Patient with hypertension (PIH/Preeclampsia/Eclampsia) or pre-term women
2. Patients with congenital malformations and any chronic diseases,
3. Twin /multiple pregnancies, RH negative pregnancy. Diabetes Mellitus (GDM)
4. Women who not provide consent for the study

Baseline demographic profile of both the mother and the baby with anthropometric parameters (including weight, length and head circumference) of the baby were noted at birth. Three mL each of cord blood and maternal venous blood (within 2 hours of delivery) was collected for hemogram with indices, iron profile, ferritin and transferrin saturation at birth. Babies were discharged within 48 to 72 hours of birth on exclusive breast feeding.

Serum iron level was measured at 2nd and 3rd trimester of pregnancy and compared with the neonatal birth weight.

Statistical Analysis: data were analysed statistically by using SSPS version 22. Mean, standard deviation and percentage were calculated. Chi quire test was performed. P value <0.05 considered statistically significant

Results

Out of total 100 pregnant women, their Pre Pregnant Weight as follows: 14 (14%) were 40 – 45 kg , 36 (36%) were 46 – 50 kg, 24 (24%) were 51 – 55 kg, 13 (13%) were 56 – 60 kg and 13 (13%) were >60 kg. 68% were rural & 32% were urban population. 8% pregnant women were <20years of age, 85% were in between 20-30 years of age and 7% were >30 years of age.

Out of 100 neonates, 59 (59%) were male & 41 (41%) were female in our study. 4 (4%) neonates weighed >3.9 kg , 50 (50%) and 46 (46%) neonates were in the range of 2.5-3.899 kg and 1-2.499 kg respectively.

Table 1: Socio-demographics and anthropometric Parameters of pregnant women and neonates enrolled in the Study

Parameters		Frequency (N=100) (%)
Maternal age	< 20 year	8 (8%)
	20-30 year	85 (85%)
	>30 year	7 (7%)
	Mean ±SD	**25.25 ± 3.62 years**
Locality	Rural	68 (68%)
	Urban	32 (32%)
Maternal Pre Pregnancy Weight	< 50 kg	50 (50%)
	50– 55 kg	24 (24%)
	>55 kg	26 (26%)
	Mean ± SD	52.52 ± 6.28 kg
Gender of Neonates	Male	59 (59%)
	Female	41 (41%)

Neonatal Birth Weight	≥3.9 kg	4 (4%)
	2.5 – 3.899 kg	50 50%)
	1 – 2.499 kg	46 (46%)
	Mean ± SD	2.46 ± 0.55

Among 100 neonates AGA, SGA, LGA, IUGR were 58%, 38%, 1%, 3% respectively

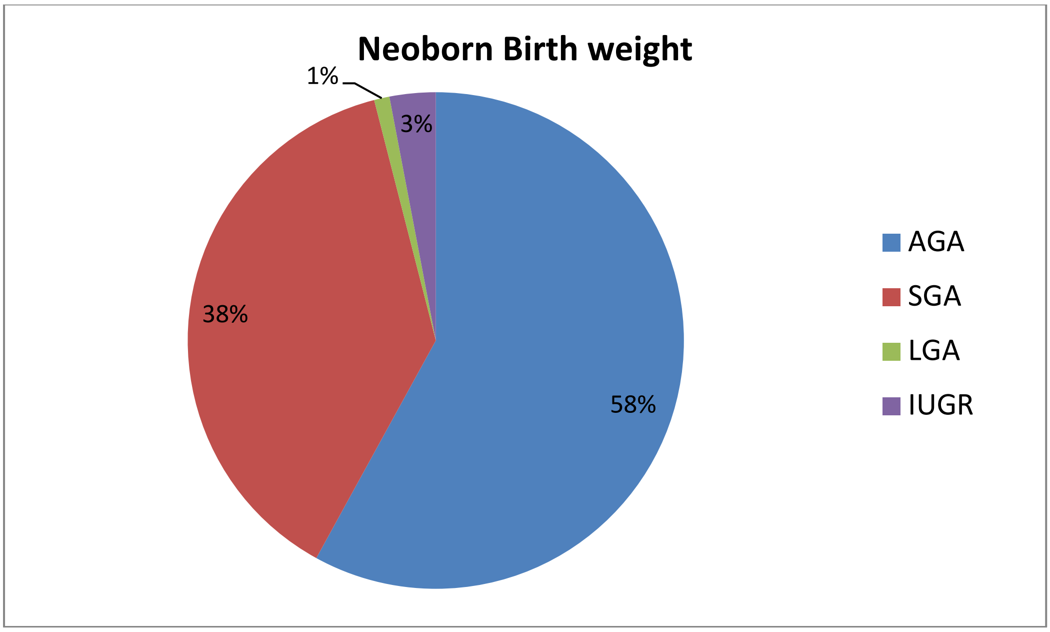

Figure 1: Weight of neonates included in this study

The results show positive correlation that is birth weight of neonates and S. Iron (mcg/dl).

Table 2: Correlation between mean neonatal birth weights with mean serum Iron level

Parameters	Birth weight (kg)	S. Iron (mcg/ml)	P value	Results	Correlation
2nd trimester Mean ±S.D	2.46 ± 0.55	42.93 ± 9.35	<0.0001	Significant	Positive
3rd trimester Mean ± S.D	2.46 ± 0.55	37.065 ± 9.48	<0.0001	Significant	Positive

Neonatal growth retardation was significantly associated with the serum iron levels in 2nd trimester ($p<0.05$) whereas not significant in 3rd trimester ($p>0.05$).

Table 3: Correlation between neonatal growth retardation with Serum iron Levels

Parameter		**Serum iron Levels (mcg/dl)**		**p value**
Trimester	**Neonatal Birth weight**	Low (<44)	Normal (44–173)	**0,004**
2nd trimester	LBW (1 – 2.499 kg) (n=46)	37 (37%)	9 (9%)	
	Normal (2.5 – 3.9 kg) (n=53)	17 (17%)	36 (36%)	
	LGA (>3.9 kg) (n=1)	0 (0%)	1 (1%)	
3rd trimester	LBW (1 – 2.499 kg) (n=46)	43 (43%)	3 (3%)	**0.101**
	Normal (2.5 – 3.9 kg) (n=53)	40 (40%)	13 (13%)	
	LGA (>3.9 kg) (n=1)	0 (0%)	1 (1%)	

Discussion

Iron accretion occurs mainly in the third trimester. Therefore, premature infants may not receive enough iron at birth because they miss the opportunity to accrete iron during the last trimester. Likewise, intrauterine growth retardation could be disturbed by iron accretion due to placental insufficiency [13]. In our study majority of the pregnant women was 20-30 years age group with mean age was 25.25 ± 3.62 years, consistent finding reported by Jones, A.D. et al [14] and Joy Y, et al [15]. In this study 59% neonates were male, concordance with the Bazmamoun, H, et al [16] and Sheffield M, et al [17].

In the present study 58% newborn were average gestational age (AGA) and 38% were short gestational age (SGA), in agreement to other researchers: Ataide R, et al [18] and K Sharma, et al [19].

The mean neonatal birth weight was 2.46 ± 0.55 kg in the current study, accordance with the Surekha M, et al [20]. A study done by Akkurt et al [21] observed that maternal ferritin was higher in the SGA group as compared to the AGA group babies. Significant proportion of term SGA neonates develop IDA and need iron supplementation. There are no existing guidelines for prophylactic administration of iron in term SGA neonates

A study was done by Durie DE, et al [22] found that suboptimal 2nd & 3rd trimester rates of gestational weight gain in the most obese women do not increase the probability of SGA neonates to born. Excessive rates of gestational weight gain increase the odds of LGA neonates regardless of BMI.

In our study positive correlation was found between the birth weight of neonates and maternal serum iron level, our results were similar with the other studies conducted by Aranda N, et al [23] and Shi et al [24]. Supplemental iron had a positive impact on birth weight among women with pre-pregnancy low iron stores and did not affect birth weight among women with present iron stores. Current study observed positive correlation between birth weight of neonates with 2nd and 3rd trimester serum iron levels but their correlation was statistically not significant in the 3rd trimester ($p>0.05$), our results comparable with the R Ataide, et al [25].

Conclusion

Iron is important micronutrients for both pregnant women and newborn. In this study, it has direct impact on newborn birth weight. On IFA supplementation, neonatal birth weight also improved. Maternal serum Iron sup-plementation has a statistically significant and positive association on birth weight and an inverse association with incidence of LBW, SGA and IUGR.

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