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Importance of serum ferritin level in the prediction of fetal birth weight

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Abstract

The weight per gestational age reflects an embryo's and infant's growth rate, and is also expressed as the weight in comparison to what would be predicted by the gestational age. Ferritin is an iron-binding protein that helps to make iron-containing proteins like haemoglobin (Hb) and myoglobin. The iron reserves in the bone marrow are strongly associated with ferritin levels. And is reduced until a change in transfirren saturation, serum iron, or (Hb) concentration occurs, making its estimation superior to transferring saturation or serum iron concentration in the diagnosis of iron deficiency. The aim of our work is to study the importance of serum ferritin level in the prediction of fetal birth weight as appropriate for gestational age, small for gestational age or intrauterine growth restriction. A total of our study included (90) pregnant women who had admitted to Salahuddin general Hospital Obstetric emergency ward, at the time of delivery during the period of last 7 months from November 2020 till May 2021.Our study revealed that there is highly significant relation between serum ferritin at the time of delivery and fetal birth weight. Based on our findings, we can derive that there is a correlation between ferritin levels in maternal serum at the delivery time and birth weight. The number of parities also had an impact on birth weight and maternal serum ferritin levels at birth. To avoid maternal and fetal complications, it is important to diagnose and treat maternal iron deficiency in the antenatal period. Iron supplementation initiatives are being implemented to reduce the prevalence of iron deficiency and its negative impact on fetal development.

Keyword: serum ferritin, ferritin, birthweight.

Introduction: -

The weight of the fetus or newborn at birth is referred to as birth weight. The birth weight of a fetus or newborn child is frequently seen as an essential sign of maturity and, to some degree, physical development (1). Appropriate for gestational age refers to a baby born within the average weight limit for that gestational age (AGA). An abnormally slow growth rate causes the infant to be small for gestational age, while an abnormally fast growth rate causes the infant to be large for gestational age. Ferritin, an iron storage protein, is the principal mechanism for iron storage and is essential for maintaining iron homeostasis. Ferritin protects lipids, DNA, and proteins from the Potentially harmful effects of iron while making iron accessible for crucial cellular functions. In clinical practice, ferritin changes are widespread, and they typically signal disturbances in iron homeostasis or metabolism. Ferritin is now widely acknowledged to have a role in a variety of different disorders, including inflammatory, neurological, and malignant disorders (2)**.** Iron is required for the metabolic activities that result in tissue oxygenation. The typical person has 3-5 grams of iron in their body. A typical diet can provide up to 15 milligrams of iron per day. Iron absorption in the first and second portions of the small intestine is aided by the acidic environment. Co-administration of acidic chemicals, such as ascorbic acid, helps to increase iron absorption. Iron absorption is usually increased in response to increased demands. Protein-bound iron is carried into the bone marrow after absorption for integration in the creation of red blood cells, and excess iron is stored as ferritin, a labile and readily accessible iron source (3). Plasma ferritin is the most

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accurate indicator of total body iron, with low levels indicating iron deficiency. Inflammation, infection, and preeclampsia have all been linked to high levels. Ferritin is produced in a variety of tissues, with the liver being one of the most important. Placental tissue produces a form of ferritin called placental isoferritin, and blood levels of this isoferritin have been linked to pregnancy outcomes (4).

The purpose of this work

In asses' maternal serum ferritin level at time of delivery in linked to the fetal birth weight.

Subjects and Methods

This study including (90) pregnant women who had admitted to Salahuddin general Hospital Obstetric emergency ward, at the time of delivery during the period of last 7 months from November 2020 till

May 2021. 90 pregnant women in singleton pregnancies between 37- 41weeks' gestation were admitted to the delivery unit, all of whom appeared to be in good health.

Data collection;

All pregnant women in the study were subjected for data collection through:

Full history taking including: Maternal age, gestational age, gravidity, medical disease, previous operation, previous abortion, previous neonatal death and previous IUFD –
Complete physical examination: - Examination findings and exclusion of medical disorders. The females were examined for fundal level, pelvic examination for cervical dilatation, cervical effacement, station, progression of labour.
Fetal assessment: Assessment of fetal outcome birth weight to the nearest gram by electro- metal scale, assessment of Apgar score at 1minet, 5minet and 10minet.
Methods: In this study were pulled five mL of the venous blood from each healthy pregnant woman thought syringe, then the blood was put in the gel tube at the time of delivery, then after that, it was leaved to be coagulation, then separated by centrifuged at three thousand (rpm) for 10 (mints) to get serum. The obtained serum was used to check the concentration of ferritin using ELISA kit supplied by SunLong Biotech Co., LTD.
Statistical analysis:

A statistical software package was used to perform the analyses programming SPSS variant 23.

Result: -

A sum of 90 pregnant women, where they are divided to 2 groups according to the parity. First group nullipara women where aged ranged from (16-36) years with a mean (23.68 ± 4.11) years, the gestational age was ranged from (37-41) with the mean of gestational age was (38.9 ± 1.11) weeks, and also the fetal birthweight was ranged from (2.3- 4.5) with the mean birth weight was (3.02 ± 0.72). While 2nd group (grandmultipara women) where aged ranged from (18-40) years with a mean (31.82 ± 5.79) year, the gestational age was ranged from (37- 41) with the mean gestational age was (38.65 ± 0.86) weeks, and also the fetal birthweight was ranged from (2.2-4.5) with the mean birth weight was (3.35 ± 0.59).as showing in table (1).

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Table 1: Demographic, maternal age, BMI, Gestational age at delivery and baby birthweight of women with nulliparous and grand multiparous.

Maternal age, BMI, and baby birthweight were essentially higher in grandmultipara women in comparing with nullipara women at ($p < 0.05$). Apgar score was done to the fetus after 1-minute 5minute after delivery, Apgar score at 1-mint and at 5-mint were showed higher in grandmutilpara women than nullipara women, (9.52± 0.90 versus 9.46 ± 1.21, $P > 0.05$), and

Groups / Parameters	Nulliparous No. (50)	Grand multiparous No. (40)	P value
Maternal age (years)	23.68 ± 4.11 (16-36)	31.82 ± 5.79 (18-40)	*0.0001
Body mass index (Kg/m2)	27.82 ± 4.64 (20.4-40)	30.35 ± 4.0 (24.1-40.7)	*0.007
Gestational age at delivery (weeks)	38.9 ± 1.11 (37-41)	38.65 ± 0.86 (37- 41)	0.579
Baby birth weight (kg)	3.02 ± 0.72 (2.3- 4.5)	3.35 ± 0.59 (2.2-4.5)	*0.020

(9.97± 0.15 versus 9.9 ± 0.50, $P > 0.05$). Serum ferritin was done to both groups at the time of delivery and was showed higher in 2nd group than 1st group, (33.05 ± 33.01 versus 32.74 ± 17.53, $P > 0.05$) as shown in table (2).

Table 2: Demographic, Apgar score at 1-mint and 5-mint, and serum ferritin of nulliparous and grand multiparous women.

Groups / Parameters	Nulliparous No. (50)	Grand multiparous No. (40)	P value
Apgar score at 1 min	9.46 ± 1.21 (5-10)	9.52± 0.90 (7-10)	0.772
Apgar score at 5 min	9.9 ± 0.50 (7-10)	9.97± 0.15 (9-10)	0.326
serum ferritin	32.74 ± 17.53 (10-92)	33.05 ± 33.01 (7-204)	0.956

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Table 3: correlation between ferritin and some variables

		Serum ferritin
Age (years)	R	- 0.084
	P	0.429
BMI (Kg/m2)	R	0.033
	P	0.759
Gestational age	R	0.001
	P	0.989
Apgar score at 1 mint	R	-0.003
	P	0.981
Apgar score at 5 mint	R	0.088
	P	0.407
Fetal birth weight (g)	R	**0.303
	P	0.004

Discussion: -

Iron (Fe) is required for a variety of physiological processes, including Hb (hemoglobin) synthesis, cell growth, and development [5]. Depletion of stored iron causes iron deficiency. Increased iron demand during pregnancy can exacerbate this, leading to iron deficient erythropoiesis and iron deficiency anemia [6]. It's unlikely that dietary iron would be able to satisfy the pregnancy-induced rise in demand if the body iron store is insufficient at conception. [5].

It is well understood that maternal nutrition during pregnancy has an impact on birthweight and development, particularly in the first several years of life. Normal growth is also influenced by birth weight. The biological mechanisms through which maternal iron status affects fetal metabolism and development are poorly understood. Anemia-related causes, on the other hand, can have an effect on infant growth by affecting hormone production, placental size, or vascularization [7].

In contrast to the grand multiparous women category, nulliparous women had a slightly lower maternal age (23.68) years and a smaller body mass index (30.35) kg/m2. In contrast to nulliparous women, grand multiparous women had a substantial rise in baby birth weight (3.02) kg. These results are consistent with the results of the Addah, A. O. et al. (8). The mean birth weight of babies born to grand multiparas was higher than that of babies born to nulliparous women in the study. Nulliparous women, by default and according to reports, have lower birth weight babies than grand multiparous women [9].

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These findings are identical to those of the Nigerian Demographic and Health Survey, which reveal that fetal weight rises from the second to the sixth birth, but they vary from those of a major cohort study in Bethesda, which showed that birth weight increases gradually from the second to the fourth pregnancy and then starts to decrease [9]. The high rate of macrosomic births in grand muliparous women in this study demonstrates that as the prospective mother ages, so does the birth weight [9].

There was no significant different in APGAR scores at 1 minute and 5 minutes in grand multipara women compared to nulliparous women in this study ($P \geq 0.05$). The findings of this study agree with those of Hoque, M., et al. (10). There were no differences in the rates of low-birth-weight delivery and mean APGAR scores of newborns in 1 and 5 minutes among different parity classes, according to the study.

In addition, no substantial increase in ferritin was observed in grand multipara women compared to nulliparous women in this study ($P \geq 0.05$). The findings support Singh, Samiksha, et al. (11), who noticed that ferritin deficiency was highest in nulliparous women and lowest in grand multiparous women.

We found a non-significant relationship between ferritin and gestational age, APGAR scores at (1, 2) mints, and maternal age (P-value >0.05) in our study. This agrees with Owais et al. (12) who found no significant relationship between serum ferritin and maternal age and Apgar score.

In addition, our findings revealed a strong significant relationship between serum ferritin and fetal birth weight (P-value < 0.01), which is consistent with Fakher, D. et al (13). High ferritin levels were linked to a lower mean birth weight and a higher proportion of births weighing less than 2500 grams at 36 weeks, according to the study.

Conclusion and recommendations:

Ferritin, an iron storage protein, is the basic mechanism for iron storage and is important for maintaining iron homeostasis. Ferritin allows iron to be used in key cellular activities while protecting lipids, DNA, and proteins from the potentially harmful effects of iron.

We found a significant association between serum ferritin at the time of delivery and baby birth weight between parity groups, as well as a non-significant correlation between serum ferritin of the mother at the time of delivery and gestational age, maternal age, and Apgar score (P-value > 0.05) in a study of 90 pregnant women at the time of delivery.

According to our data, we can conclude that there is a positive association between the level of serum ferritin in maternal serum at the time of delivery and birth weight. Also found that number of parities affecting in birth weight and level of maternal serum ferritin at birth.

Our findings confirm that serum ferritin deficiency in women of reproductive age is a public health issue. Because these deficiencies are linked to poor foetal and maternal outcomes, nutrition supplementation programs should focus on delivering these micronutrients, particularly to women of childbearing age.

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