Significance Of Ferritin In Pregnancy Associated Iron Deficiency Anemia, GDM And Other Complications

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***Abstract*- Purpose**: Analysis of ferritin is very important in pregnancy for predicting risk factors such as GDM, IDA, preeclampsia, preterm delivery, childbirth weight, and other pregnancy-related complications. The only commonly used laboratory test for determining iron reserves is the determination of serum ferritin concentration. As a result, the complications associated with ferritin is caused by an increase or decrease in body iron stores.

Methodology: The review is intended to look into the impact of ferritin in pregnancy.

Sources of data and study selection: Relevant articles were chosen through a database search on Google Scholar, PubMed, and ScienceDirect. The journal papers were chosen from the years 2015 to 2022, with the majority falling between 2017 and 2022. Excludes papers published before 2015 and reviewed only full-text articles.

Findings: We investigated the bond between serum ferritin levels and pregnancy-related complications in this systematic review. We discovered that high maternal serum ferritin levels play an important role in the occurrence of GDM. We've also discovered that ferritin in gestating women can be implicated as a marker for preeclampsia, preterm birth, and decreased ferritin levels are related with IDA and low birth weight. We also discovered some negative correlations. As a result, more research is needed to establish this relationship and identify vulnerable populations.

Paper Type: Systematic Review Paper.

***Index Terms*-** Ferritin, Iron stores, Pregnancy, Iron deficiency, Gestational diabetes, Preeclampsia

I. INTRODUCTION

FERRITIN

Ferritin is an intracellular protein that surrounds the nucleus. It stores iron, a nutrient that is necessary for the production of healthy red blood cells and the distribution of oxygen throughout the body. When the body uses iron, a small amount of ferritin is released from cells and circulates in the blood. Ferritin level reflects the total iron stored in the body.

Without inflammation, ferritin concentrations are positively correlated with the storage form of iron in the body. Low serum ferritin levels show that these stores have been depleted, resulting in iron deficiency.

IRON DEFICIENCY

In both developed and developing countries, iron deficiency is the most common nutritional disorder among pregnant women. Iron deficiency affects approximately 41.8% of pregnant women, according to UNICEF (1998). [1] Iron is required for all cellular functions, such as oxygen transportation, electron transport, and enzyme activity. Cells with high metabolic rates require more iron and become more dysfunctional when there are insufficient iron stores. [2] Iron deficiency ranges from iron depletion to iron deficiency anemia. The amount of stored iron (as measured by serum ferritin) is reduced in iron deficiency, but the amount of transportable and functional iron may not be affected. People who are iron deficient do not have iron stores to call on when their bodies require more iron. Stored iron is depleted, and transport is impaired in iron-deficient erythropoiesis.

The definition given to anemia in pregnancy by WHO as a hemoglobin concentration <110 g/l (WHO, 20 01) [3]

Diagnosis of iron deficiency

Clinical symptoms and signs
Laboratory tests
Full blood count, blood film and red cell indices.
Serum ferritin
Serum iron (Fe) and total iron binding capacity (TIBC).
Zinc protoporphyrin (ZPP
Soluble transferrin receptor (sTfR
Reticulocyte hemoglobin content and reticulocytes
Bone marrow iron
Trial of iron therapy.

It is established that iron deficiency affects several bodily functions, including physical and mental performance, enzymatic functions (eg, the respiratory chain), thermoregulation, muscle function, immune response, and neurological function. Only some of these potential effects have been reported and specifically

studied in iron deficiency anemia. Iron deficiency anemia usually causes several symptoms. [5]

IRON DEFICIENCY IN PREGNANCY

The need for iron increases trivially during gestation as the mother's blood volume increases and the fetus get bigger and increase in weight. Thus, pregnancy is a state of imminent or current iron deficiency that can be difficult to detect because of the limitations of generally implicated biomarkers like hemoglobin and ferritin levels. Iron deficiency is linked to negative pregnancy outcomes such as increased risk of premature birth, low birth weight baby, and postpartum depression. The swiftly evolving fetal brain is especially vulnerable to iron scarcity, which can be caused by depleted iron in the mother, high blood pressure, smoking, or glucose intolerance. Some neuro developmental conditions, mental disorder which is distinguished by a wide range of unusual behaviors in offspring, are linked to low maternal iron intake during pregnancy. Despite postnatal iron supplementation, iron-deficient neonates have impaired recognition memory, slower processing speed, and poor communication. [2] A decrease in iron stores in a newborn baby can last up to one year and cause iron deficiency anemia.[6]

Iron deficiency anemia (IDA) is the most common reason for anemia during pregnancy in developing countries and is coupled to an increased risk of low-birth-weight babies. In developed countries, iron supplementation is based on serum ferritin levels.[7]

COMMON IMPACTS

The aftereffects of iron deficiency during pregnancy are noteworthy and widespread. These were previously thought to be limited to increased maternal risk, but recent work has illustrated that the fetus and newborn also suffer both short- and long-term consequences, particularly in brain function.[4] Some of these implications are outlined in this review. Anemic mothers often experience increased fatigue, reduced exercise capacity, and mental performance.

GESTATIONAL DIABETES

Of the exclusive pregnancy-related complications, gestational diabetes is the predominant. The incidence of gestational diabetes has increased. Gestational diabetes is estimated to be found in approximately 14% of all Pregnancies. Gestational diabetes is a disease caused by impaired carbohydrate metabolism tolerance. The disease occurs in varying degrees of severity and is detected in primary pregnancies. Gestational diabetes begins most often after the 24th week of pregnancy and the disease resolves after delivery. The worry about gestational diabetes is that the onset of diabetes coincides with the period of maximum fetal growth during pregnancy. One of the fundamental mechanisms used to explain the development of Gestational diabetes is obesity-related to oxidative stress and systemic inflammation.An abnormally high level of elemental iron is one factor that causes free radical production and inflammation. There is evidence that evaluation of ferritin in patients with gestational diabetes can predict delivery outcomes accurately, but there are some gaps that need to be answered, especially in India.[12].

OTHER COMPLICATIONS

Severe anemia (Hb < 90 g/l) can accompany preterm delivery, resulting in low birth weight, small gestational age, and spontaneous abortion. In addition, maternal IDA may contribute to low iron levels and poor health in children. Fetal iron metabolism completely depends on maternal iron transfer to the placenta, so the effect of anemia on the fetus is directly related to the extent of maternal iron deficiency and the increased mortality associated with severe IDA.[8] Serum ferritin is significantly elevated in pregnant women with preterm labor and preterm PROM.[9] [11] If the serum ferritin level is high, treatment can be prevented premature birth. The study result adds to the existing evidence that high serum ferritin is a risk factor for preterm birth.[10]

The impact of iron deficiency anemia in mother and fetus is described in table 1

Table 1:

MOTHER	FETUS
Increased risk of developing pre-eclampsia and bleeding. Increased risk of developing gestational diabetes Tiredness	Premature labor fetal death low birth weight

FERRITIN IN PREGNANCY

The evaluation of ferritin in pregnancy can be used as a marker of iron deficiency anemia, gestational diabetes, and other complications. This systematic review was prospectively designed to investigate serum ferritin's significance in diagnosing iron deficiency, gestational diabetes, and other maternal and fetal complications.

II. OBJECTIVE :

Evaluation of ferritin is becoming an important issue of concern nowadays in pregnancy.

This analysis studies the significance of ferritin assessment in pregnancy in predicting the risk of IDA, gestational diabetes, and other complications of mother and the baby.

III. METHODOLOGY :

This review is assigned to evaluate the sense of ferritin during the gestational period. Database search selected relevant articles on Google scholar, PubMed, and Science Direct. I selected the journal papers from the year 2015-2022. Excludes the papers before 2015 and reviewed only full papers.

IV. REVIEW OF LITERATURE :

For both the health of the mother and the growth and development of the fetus, iron is crucial throughout pregnancy. Much research has concentrated on the effect of low hemoglobin levels on pregnancy outcome since iron deficiency anemia affects

billions of individuals globally. Iron, however, is necessary in lot of functions as well, such as the formation of neurotransmitters, myelination, intracellular oxygen transport, cellular respiration, and cell growth. Even without anemia, these processes can be hampered by iron deficiency. Currently, ferritin, transferrin saturation, or soluble transferrin receptor concentration (sTfR) are used to evaluate iron status. Preferable techniques and clinically significant cut-offs for iron insufficiency or overload in pregnancy have not yet been established.

Pregnancy-related iron insufficiency poses dangers to both the mother and her unborn child. However, there is still a dearth of proof that systematic iron supplementation improves clinical outcomes other than hematological indicators. Investigations on both humans and animals have suggested that too much iron may be hazardous. An excessive amount of iron increases the incidence of cardiovascular disease, gestational diabetes, and fetal difficulties, as well as produces oxidative stress and cellular damage.[13] Although hemoglobin is a late measure and might not accurately mirror the iron in tissue, ferritin concentrations and hemoglobin percentage are both indicators of iron shortage. Serum ferritin (SR), however, is typically regarded as the most accurate indicator of iron insufficiency in pregnancy. The level drops early in the progression of iron insufficiency, and recent iron intake has little impact on it.[14]

To determine the importance of ferritin in pregnancy for the prior diagnosing of iron deficiency anemia, gestational diabetes, and other pregnancy outcomes, the current study evaluated several studies.

Table 2: Related articles: Elevated ferritin and GDM

Sl .no	Research topic	Findings	Reference
1	Ferritin and intrapartum diabetes mellitus	The case-control study was conducted at a general hospital in Iran. Researchers ruled out a major tie between serum ferritin level and GDM irrespective of BMI and c-reactive protein.	15
2	Plasma Ferritin in Early Pregnancy Associated Gestational Diabetes mellitus	The prospective nested case–control study of pregnant Women proved the fact that plasma ferritin in early pregnancy were outstanding and positively associated with GDM risk even after adjustment for pre-pregnancy BMI and additional GDM risk factors. The association remained significant after adjustment for markers of systematic inflammation and oxidative stress.	16
3	Serum ferritin in early pregnancy	Researchers showed correlations between increases in serum ferritin levels during the first trimester of pregnancy and the GDM risk for expectant mothers. As a result, having a high ferritin level is a serious risk factor for developing gestational diabetes.	17
4	Outcome in GDM pregnancies	From December 2016 to July 2020, the Ks Hedge college Hospital served as the site of this case-control study. The study involved pregnant women between the ages of 20 and 40 who were diagnosed with gestational diabetes mellitus (GDM) by the American College of Obstetricians and Gynecologists (ACOG) at the time of their antenatal checkup and non-GDM pregnant women. They came to the conclusion that GDM is likely to be associated with high serum ferritin levels compared to non-GDM moms and that it is possible to predict the prognosis of the mother and the newborn by evaluating serum ferritin levels.	12
5	Ferritin: A meta-analysis of observational studies.	Prior to May 10, 2019, they conducted relevant searches on the databases to ascertain the connection between ferritin and GDM. The consequence of this meta-analysis imply that higher ferritin levels are hooked up to a higher risk of developing GDM; however, additional prospective cohort studies are needed to corroborate the findings, particularly the dose-response association between ferritin and GDM.	18
6	Correlation between plasma ferritin level and gestational diabetes mellitus and its impact on fetal macrosomia	Pregnancy-related diabetes mellitus poses a significant public health risk since it raises the likelihood of maternal, fetal, and neonatal problems. OS, which is regarded as a risk factor for GDM, is linked to iron. When the plasma ferritin level is greater than 70 ng/mL, taking iron supplements is not advised. Ferritin levels and other features between	

		pregnant women with gestational diabetes mellitus (GDM) and pregnant women without GDM were retrospectively compared by Zhiguo Wang et al. Researchers have investigated the association between ferritin, glucose, and hemoglobin levels. They evaluated the macrosomia risk factors in the interim. They also looked into the connection between ferritin levels and the prevalence of macrosomia. According to the study, those with high ferritin levels may be more susceptible to GDM and a standalone reason for macrosomia. Therefore, it may be noted that iron supplementation during pregnancy has a deleterious impact on non-anemic pregnant women.	
7	Role of ferritin and oxidative stress index	According to Surabhi Gautham et al. in 2021, elevated pre-pregnancy BMI raises blood ferritin and OSI, which predisposes to gestational diabetes.	20
8	Association of Serum Ferritin with Gestational Diabetes Mellitus	Recently, it has been reported that GDM also exhibits elevated blood ferritin levels, which are generally linked to insulin resistance and diabetes. Serum ferritin's function has gained more recent attention. Type 2 diabetes and other illnesses are more likely to develop because of iron excess and the oxidative stress it causes. The extraction, synthesis, and release of insulin are hampered by the accumulation of iron in cases of iron overload. A high ferritin level is very much related to a high possibility of gestational diabetes mellitus (GDM) Dr.Shameem Mahmood et al. Concluded that those with GDM showed high ferritin than without GDM. Therefore, raised ferritin can be considered as a sign of GDM.	21
9	Association of ferritin in mid-pregnancy and the risk of gestational diabetes mellitus	Serum ferritin levels, in addition to iron store activity, are an excellent predictor of developing GDM, according to DR. V Sumathy et al. Early in the prenatal weeks, elevated ferritin is linked to a higher risk at the beginning of GDM. Partially, mother's fat mass and obesity handle this relationship.	22
10	Serum ferritin thresholds: a systematic review	This systematic analysis illustrates the heterogeneity in serum ferritin thresholds used in research settings to identify iron insufficiency in pregnancy. This difference was observed in many study designs evaluating the results of therapies involving iron in various populations and geographical regions. A review based on the ferritin threshold to interpret iron scarcity in pregnancy is clogged due to the lack of published data. The information in this evaluation shows that there is no agreement on a particular serum ferritin threshold for determining iron deficiency. The difference in thresholds complicates the diagnosis and treatment of iron deficiency during pregnancy, which has negative effects on mother and the unborn child.	23
11	The effect of ferritin, vitamin B12 and folic acid on pregnancy outcomes	The body's iron stores are thought to be showed by the serum ferritin level. Even though plasma dilution may impact the ferritin level later in pregnancy, iron depletion is indicated at all stages of pregnancy by a concentration below 15 g/l. Pinar kalem etal, in their retrospective study, found that the style of delivery, the timing of delivery, the weight, and the overall health of the infant are unaffected by anemia in the third trimester.	24

12	Evaluation of iron deficiency by serum ferritin assay in a population of anemic moroccan pregnant women	As in many poor nations, this study showed that iron deficiency is a problem in our nation as well. It is the major factor in anemia in expectant mothers. Serum ferritin assays continue to be the ultimate precise iron metabolism exploration test to determine pregnant women's iron stores, surpassing the straightforward full blood count that is advised in the early stages of pregnancy. The initial sign of iron deficiency is a decrease in this parameter, but it is also the last test to be standardized with replacement therapy, which must be continued until the iron store is normalized.	25
13	Low serum ferritin and G6PD deficiency as potential predictors of anemia in pregnant women visiting Prime Care Hospital Enugu Nigeria	Anemia in pregnancy is closely correlated with low serum ferritin levels and G6PD deficiency as potential risk factors, according to the study's conclusion by Goodwill Azeh Engwa et al.	26
14	First Trimester Ferritin Outperforms Soluble Transferrin Receptor and Hepcidin in Predicting Anemia in the Third Trimester: Results from an Indonesian Cohort Study	According to the cohort study, the best predictor for predicting anemia in the third trimester was the serum ferritin level in the first trimester (27.23 ng/ml). It will be helpful in identifying subjects for a stricter approach to the prevention and treatment of anemia in pregnancy, particularly in settings with limited resources. A carefully planned randomized controlled study would be required to determine the utility of ferritin as a marker to treat anemia in pregnancy.	27
15	Serum ferritin as an indicator of iron status: what do we need to know?	In most circumstances, it is impractical to determine the lack of bodily iron stores. The most often used biomarker for identifying ID is ferritin and low SF concentrations directs to iron deficiency status. Suggestion: Future research is critically required to establish the proper SF cutoffs, and this will provide us the chance to compare this signal to other established and developing iron indexes. Future study should also concentrate on clarifying cutoffs and indexes related to iron adequacy.	28
16	Population-based study in pregnancy	This was a population-based study on ID from three different blood-based indicators in a multiethnic sample of healthy pregnant women, where only a small percentage of women (18%) used iron supplements in the early stages of pregnancy and anemia was not commonly seen in Western Europeans. Depending on the iron indicator utilized, there were significant differences in the prevalence of ID. Ferritin had the highest prevalence of ID, whereas sTfR had the lowest.	29
17	Assigning ferritin thresholds.	The goal of the review was to understand the landscape of serum ferritin in diagnosing iron deficiency in the aetiology of pregnancy anemia. In defining the ferritin threshold of iron deficiency in pregnancy, the literature, including national guidelines and primary studies of iron interventions, there was variation. Suggestion: further studies have to be done in determining serum ferritin threshold for the diagnosis of anemia in pregnancy.	30
18	Comparison of Ferritin with Other Iron Status Markers	KELD-ERIK BYG et al. conducted the study to determine the true positive and false positive rates of iron status markers (serum iron, serum transferrin, transferrin saturation, hemoglobin, hematocrit, mean corpuscular volume (MCV), mean cell hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), erythrocyte count) in the diagnosis of iron depletion during normal pregnancy and postpartum. And they found that, the sensitivity of the other iron status markers was too low, and the false positive rates were too high, to be clinically useful in the diagnosis of iron deficiency. Despite physiological variations caused by hemodilution, serum ferritin concentration is currently the	

		most reliable non-invasive indicator of iron status in pregnancy and postpartum.	
19	IRON DEFICIENCY ANEMIA Significance of serum ferritin in diagnosis of pregnant females of Pakistan	According to the findings of this study, serum ferritin is a better and more reliable marker than hemoglobin for detecting iron deficiency anemia during pregnancy, especially at the latent stage, and ferritin should be included in routine antenatal care programmes to improve the health of Pakistani women.	32
20	Serum or plasma ferritin concentration as an index of iron deficiency and overload	In the review the author found that blood ferritin concentration is reasonably sensitive and specific for iron deficiency in people presenting for medical care at a threshold of 30 micrograms/L, according to low-certainty evidence. There is very little certainty that high ferritin concentrations provide a sensitive test for iron overload in people with this condition. There is insufficient evidence to determine whether ferritin is beneficial, When screening asymptomatic people for iron deficiency or overload.	33
21	Increased Ferritin and Iron Levels in Preeclampsia	Dr,Sujatha Maithra et al. in their study concluded that serum ferritin levels are significantly higher in pregnant women with preeclampsia. Excess iron may be a causative factor in oxidative stress, which may be involved in preeclampsia. Suggestion: more research is needed to back up this claim. Pregnant women with preeclamptic toxemia should have their iron status checked before receiving iron supplements, as these may cause more harm than benefit.	
22	Evaluation of coagulation factors and serum ferritin in preeclamptic Pakistani women	The study sought to ascertain the role of coagulation factors and ferritin in the susceptibility to PE in Pakistani women. The researchers collected blood samples from 100 normotensive and 100 preeclamptic women, including 73 with mild PE and 27 with severe PE, to assess activated partial thromboplastin time (aPTT), prothrombin time (PT), international normalized ratio (INR), fibrinogen levels, platelet count (PLT), and ferritin levels. When compared to the control groups, both PE groups had prolonged aPTT, PT, and INR, as well as lower platelet and fibrinogen levels. Researchers found that Ferritin levels were not statistically different across all study groups, but routine ferritin testing in conceived women with PE may aid in establishing a diagnosis prior to clinical manifestations, and non-anemic pregnant women should stop taking iron supplements.	34
23	Association between Serum Ferritin and Pre-eclampsia	In the review, they discovered a clear link between hauled up ferritin levels and preeclampsia. Suggested to conduct further research in a larger population may be conducted, including other parameters such as serum AST, LDH, hemopexin, total bilirubin, transferrin, and transferrin percent saturation, which may affect serum iron levels in preeclampsia	35
24	Prospective Hospital Based Assessment of the Serum Ferritin Level as A Marker of Preterm Labor	According to the findings, serum ferritin levels may be an important parameter for detecting preterm labor. Treatment to prevent preterm birth may be instituted in cases of high serum ferritin levels. The study's findings add to the growing body of evidence that high serum ferritin levels are a risk factor for preterm birth. As a result, early detection and intervention could easily prevent adverse pregnancy outcomes associated with elevated serum ferritin levels.	36
25	Elevated Serum Ferritin and Interleukin-6 Level are Risk Factors for Preterm Labor	Serum ferritin and IL-6 levels were found to be a risk factor for preterm labour. As a result, serum ferritin and IL-6 levels can predict preterm labour in the early stages. Thus, the rate of preterm labour can be reduced, as can the rate of neonatal mortality.	37
26	Serum Ferritin as a Marker for Preterm Premature Rupture of Membranes	Because it reflects an acute-phase response to subclinical infections, researchers found that an elevated serum ferritin level predicts early spontaneous preterm premature membrane rupture. When compared to a control group of women with the same gestational period, serum ferritin was significantly higher in preterm premature rupture of membranes. Serum ferritin acts as a marker for preterm premature membrane rupture	38

		and could be used by obstetricians to predict complications; it is considered more specific for prediction.	
27	Comparison of serum ferritin levels in pregnant women with preterm and term deliveries	The study found that the mean serum ferritin level was significantly higher in all preterm groups than in both term and normal pregnancies at the same gestation age. A ferritin level of 37.5 ng/mL, with a sensitivity of 78.7% and specificity of 68.7%, could also indicate preterm delivery. As a result, serum ferritin seems to be a good predictor of preterm birth.	39
28	Serum ferritin level as a marker of preterm labor	The study shed light on the serum ferritin level and role in preterm labour. Ferritin levels were significantly higher in preterm labour patients (p0.001), which gives a productive interrelation between increased ferritin and preterm labor.	40
29	Maternal iron and low birth weight	Researchers discovered that low birth weight has public health implications in this predominantly rural setting and necessitates community intervention. Iron deficiency during pregnancy has been linked to lower birthweight. Babies born to iron-deficient mothers are at risk of having a low birth weight.	41
30	Dietary iron intake, iron status, and gestational diabetes	The relationship between iron intake from food and GDM has been studied in several studies. Accumulating data suggest that dietary iron, particularly heme iron intake during or before pregnancy, is significantly and positively associated with GDM even after controlling for major dietary factors and other major well-documented risk factors for GDM.	42
31	A systematic review and meta-analysis of the correlation between maternal and neonatal iron status and hematologic indices	Maternal iron and hematologic status biomarkers correlate poorly with those in newborns/ neonates. These findings highlight the need for new methods of estimating foetal/neonatal.	43
32	Correlation of Serum Ferritin with Red Cell Indices and Hemoglobin in Indian Women in Second and Third Trimester of Pregnancy	In the study, they discovered that 59.1% of non-anemic pregnant women had iron deficiency; we recommend that iron supplementation be continued in all pregnant women in India, unlike in developed countries where iron supplementation is based on serum ferritin levels.	44
33	Association Between Serum Ferritin Concentration and Risk of Adverse Maternal and Fetal Pregnancy Outcomes: A Retrospective Cohort Study	Elevated SF concentrations between the 16th and 18th weeks of pregnancy were linked to an increased risk of GDM and SGA. Women with higher SF concentrations faced an increased risk of SGA between the 28th and 32nd week of pregnancy. Furthermore, the risk of SGA was reduced when SF concentrations were reduced appropriately at the 28-32nd week of gestation in pregnant women with GDM. As a result, SF concentration is a good predictor of the risk of adverse maternal and fetal pregnancy outcomes and can help pregnant women receive personalized iron supplementation advice at various stages of pregnancy.	45
34	Hypothyroidism and ferritin	For the first time, the study found a link between hypothyroidism and IDA during the first trimester of pregnancy. Further research with larger sample sizes, as well as thyroxine therapy in hypothyroid pregnant women and its impact on IDA, will pave the way for new therapeutic approaches to the management of IDA during pregnancy. Furthermore, serum ferritin measurements during pregnancy may provide useful information in the diagnosis and management of IDA.	46

35	Association between Maternal Plasma Ferritin Level and Infants' Size at Birth: A Prospective Cohort Study in Rural Bangladesh	The research found a negative correlation between ferritin and birth size. The researchers discovered an inverse relationship between higher maternal ferritin levels in late pregnancy and infant birth weight in their study. The findings suggested that elevated plasma ferritin levels during pregnancy could have a negative impact on birth weight.	
36	Reciprocity of high Serum Ferritin Level and Gestational Diabetes	According to the review, elevated serum ferritin in gestational age is coupled with the development of diabetes. And it can be implemented as a diagnostic marker to assess GDM in the first and second trimesters of pregnancy. Inflated iron stores have a positive relationship with GDM by causing oxidative stress.	48
37	Evaluation of serum ferritin and thyroid function in the second trimester of pregnancy	Researchers hypothesize that SF is a risk factor for thyroid dysfunction during pregnancy, although the occurrence of thyroid dysfunction in pregnant women is influenced by a variety of factors with complicated interactions. Thyroid function and SF status should return to normal quickly. Suggestions: Thyroid function and SF should be investigated in different trimesters of pregnancy, particularly in the first and third trimesters. Second, the study should be expanded to include people living in iodine-deficient or iodine-rich areas. More research is needed to ascertain the part of maternal thyroid dysfunction in fetal development in conjunction with iron deficiency.	49
38	Association of Cholecalciferol, Ferritin, and Anemia among Pregnant Women: Result from Cohort Study on Vitamin D Status and Its Impact during Pregnancy and Childhood in Indonesia	The first trimester state of cholecalciferol was found to be unrelated to ferritin in the study. Subjects with vitamin D deficiency in the first trimester were more likely to develop anemia, with the proportion increasing as the pregnancy progressed to the third trimester. Anemia in the first trimester was linked to ferritin levels in the first trimester.	50
39	Maternal Ferritin Levels during Pregnancy and ADHD Symptoms in 4-Year-Old Children: Results from the INMA–INfancia y Medio Ambiente (Environment and Childhood) Prospective Birth Cohort Study	According to the findings of a prospective birth cohort study, maternal ferritin levels during pregnancy are independently associated with ADHD symptoms in 4 to 5-year-old offspring. More specifically, maternal ferritin levels appear to influence inattention symptoms in boys, while girls appear to be more protected. Other maternal factors, such as BMI and education level, are also linked to ADHD and inattention symptoms.	51

40	Estimation of vitamin D3 and ferritin in pregnant women and relationship with hair loss.	In the study, they discovered that the level of Vitamin D3 was significantly lower in women with hair loss, and the ferritin level was low in these women during the first and second trimesters, whereas in the other group with no hair loss, the levels of Vitamin D3, serum ferritin, and other factors such as white blood cell and platelet count were normal.	52

V. RESEARCH GAP:

Serum ferritin is a well-known acute-phase reactant, with levels that correlate with the severity of acute and chronic inflammation in infectious, rheumatologic, hematologic, and malignant diseases. It is a good indicator of iron stores; however, it is usually elevated in chronic disease anemia. As a result, diagnosing IDA and other pregnancy complications that coexist with ACD is difficult. If these anemias overlap and biochemical markers cannot be used to differentiate them, a bone marrow aspiration smear stained with Prussian blue could demonstrate iron storage. Hepcidin appears to perform at least and recent additions to the repertoire of available iron indices such as sTfR and reticulocyte hemoglobin as a diagnostic test for iron deficiency. However, further analysis is needed to establish a biological marker to diagnose IDA,GDM and other complications during pregnancy and also ferritin threshold should be determined to be used as a marker.

VI. CONCLUSION:

In the review we found that high level of gestational ferritin levels presents a major contribution to the development of GDM. We've also discovered that a high ferritin level during pregnancy can be used as a marker for preeclampsia, preterm birth, and decreased ferritin levels are associated with IDA and low birth weight. We also discovered some negative correlations. As a result, more research is needed to acknowledge the correlation and identify vulnerable populations.

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