



STUDY OF RELATIONSHIP OF HbA1c AND IRON DEFICIENCY STATUS IN PREGNANT WOMEN WITH HYPERGLYCEMIA IN PREGNANCY

Obstetrics & Gynaecology

Dr. Gauri Bapat MGM Medical College And Hospital, Aurangabad

Dr. Akansha Parashar MGM Medical College And Hospital, Aurangabad

Dr. Swati Shiradkar MGM Medical College And Hospital, Aurangabad

ABSTRACT

Purpose Of Project: Indian women are prone to developing Gestational diabetes and also iron deficiency, in general as independent disease entities but since pregnancy is a condition that can itself worsen both insulin resistant status and also deplete iron stores, it becomes important to study how these conditions affect each other. **Method Used:** Women with OGCT >120 mg/dl screened out, then HbA1c, Complete Blood Count and serum Ferritin were tested in these women. Results were analysed. **Conclusion:** HbA1c is increased with increasing iron deficient status, but this negative correlation is weakly significant. **Article Highlights** Most studies performed till date, to find out the correlation between HbA1c and iron deficiency status have been done on non-pregnant adult population, and since the pregnant population is in itself a convergence point for both Iron deficiency anaemia as well as diabetogenic state, it becomes crucial for us to study this proposition in pregnant females and that too with deranged OGCT levels. Hence, diving into this research, we want to bridge the gap in ascertaining the relationship of influence of Iron deficiency on HbA1c, which can thereby create credible changes in screening, diagnosis as well as management of women with proven or alleged Gestational Diabetes Mellitus and coexistent iron deficiency status.

KEYWORDS

HbA1c, Serum Ferritin, Hyperglycaemia in pregnancy.

1. INTRODUCTION

Gestational diabetes mellitus (GDM) has been on the rise worldwide and has recently increased to 2-3 fold with current prevalence ranging over 8.9-53.4% (1)

The vast majority of cases of hyperglycaemia in pregnancy were in low- and middle-income countries, where access to maternal care is often limited (2)

Hemoglobin A1c, is the fraction of Hemoglobin A formed by glycation of the hemoglobin chain's NH₂-terminal value and is the gold standard method for evaluating glycemic control. (3)

Anemia is the deficiency of red blood cells or deficiency in total Hemoglobin content per unit volume of blood. Iron deficiency anaemia is a nutritional iron deficiency manifesting as anemia, is a cause of concern worldwide in women of all age groups. It affects 59% during pregnancy in developing countries like India. (4)

As isolated as both these disorders seem to be at the first glance, studies have shown them to be deeply intertwined. It thus becomes imperative to study both these conditions impacting the all-around antenatal care and management of the woman having hyperglycemia in pregnancy with iron deficiency status and also their impact on each other.

Since the pregnant population is predisposed to both GDM and IDA (iron deficiency anemia), we have chosen to evaluate the relationship between HbA1c and iron deficiency anemia in antenatal women.

To screen for hyperglycaemia in pregnancy, Oral glucose challenge test (OGCT) is the best laboratory test (5). And to detect iron deficient status, serum ferritin has largely proven to be the best indicator. (6)

It has been known that various factors such as iron deficiency, B12 deficiency, chronic kidney disease, chronic liver disease, alcoholism, splenectomy affect HbA1c levels (7) and many studies have been conducted to study the relationship between HbA1c and Iron deficient status, in adult diabetic population. In our study we have resolved to study this relationship in pregnant women with hyperglycemia in pregnancy indicated by their deranged OGCT levels ie; OGCT > 120mg/dl.

2. MATERIAL AND METHODS

2.1 AIM:

Assessment of correlation of HbA1c and Iron deficiency in pregnant women with hyperglycaemia

2.2 OBJECTIVES:

- To detect pregnant women with abnormal OGCT.
- To detect iron deficiency status in above sample of women.
- To detect HbA1c levels in these women.
- To assess the correlation between HbA1c and Serum Ferritin in these women

2.3 Study Centre: Department of Obstetrics and Gynaecology, MGM Medical College and Hospital, Aurangabad, Maharashtra, India

2.5 Study Design: Prospective study

2.4 Study Period: 2 years

2.7 Inclusion Criteria: Women with Gestational age more than or equal to 28 weeks who are willing to participate in study.

2.8 Exclusion Criteria:

Patients with multiple pregnancies, diabetes, hypertension, chronic kidney disease, long term steroid usage, cardiovascular disease, bleeding disorders and patients who have received recently parenteral iron therapy.

2.9 Sample Size: 100

2.9.1 Methodology:

Pregnant women visiting OPD or admitted in ward, above 28 weeks of gestation were screened for hyperglycaemia in pregnancy with 2 hour 75g OGCT. Their Serum ferritin, Hb% and HbA1c, were done and results were analysed.

2.9.2 Data analysis:

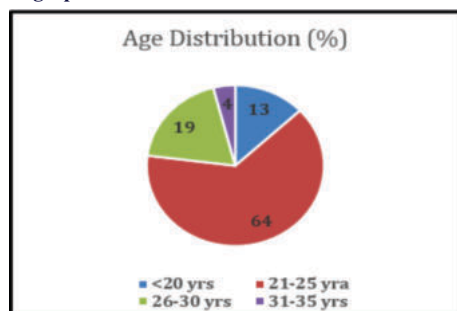
All of the information was entered into the 2013 edition of Microsoft Excel. Statistical Software for the Social Sciences version 13.0 was utilized for the categorization and analysis of the data (SPSS Inc., Chicago, IL). In order to establish the connections between the components, logistic regression and chi-squared tests for correlation were utilized. A 'p' value of less than 0.05 was considered to indicate a significant relationship.

3. RESULTS

- 41% women in our study population were diagnosed as GDM cases
- 3% women were found to have over diabetes
- 37% of women had atleast some degree of anemia (Hb<11g/dl)
- 72% women had iron deficient status.

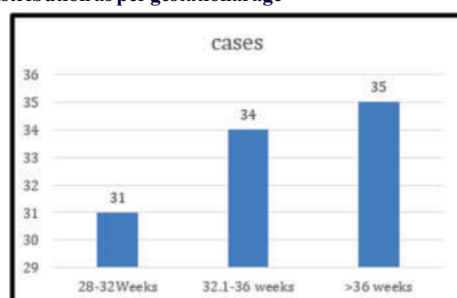
e. 28 women had HbA1c >5.7%

3.1: Demographic details



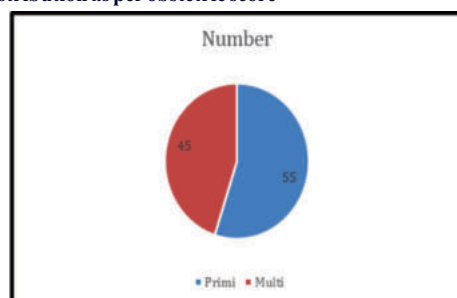
A maximum (64%) of our study population was between the age group 21-25 years. Whilst a meagre 4% of the population was in the age group 31-35 years, which is generally considered a high-risk population.

3.2: Distribution as per gestational age



The sample included women from gestational age 28-40 weeks, distributed almost equally. The mean gestational age is 33.5 weeks where changes in HbA1c can be detected as the diabetogenic action of different hormones in pregnancy starts around 20 to 24 weeks.

3.3: Distribution as per obstetric score



The sample population had, 45% multigravidas and 55% primigravidas.

3.4 : Table 1: Observations in study population

Sr No	Parameter	Range	Mean And Standard Deviation
1	Age	18-34 years	23.71+-3.344
2	Gestational age	28-40.1 Weeks	33.59+-3.65
3	Hb	7.1-14.2g/dl	11.14+-1.58

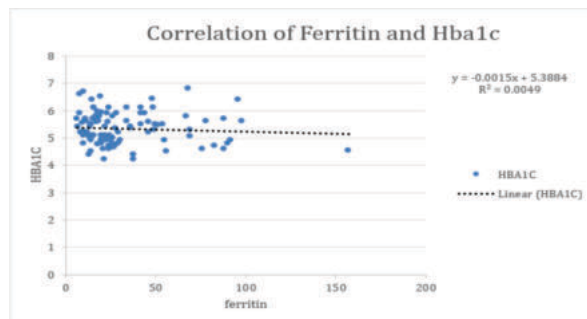
3.5: Table 2: Observations grouped as per OGCT values

HbA1c	OGCT 120-140 mg/dl	>140-200 mg/dl	Total
<5.7%	45(62.5%)	27(37.5%)	72
>5.7%	8(28.5%)	20(71.5%)	28
Total	53	47	100
Serum ferritin			
<12μ/l	2(18%)	9(82%)	11
12-40 μ /l	37(61%)	24(39%)	61
>40 μ /l	13(46.5%)	15(53.5%)	28
Total	52	48	100

3.6: Table 3 : Correlation Of Ferritin And HbA1c

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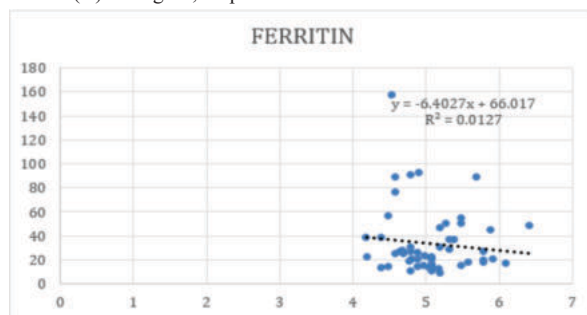
X values(ferritin)	Y values(HbA1c)	Pearson Correlation coefficient r
Mean= 33.069	Mean = 5.33	-0.0704
P VALUE The P-Value is .48. The result is not significant at p < .05.		
In this study group, correlation of HbA1c and Ferritin shows negative correlation (r=-0.0704),which was not statistically significant. (p=0.000023)		



3.7: Graph 1: Correlation Of Serum Ferritin And HbA1c

In this scatter Diagram trend line shows Negative, weak and not statistically significant correlation. For this line linear regression equation obtained

$Y(Hb) = -0.0015(X = \text{Ferritin}) + 5.3884$ That is if we put the value of Ferritin(X) = 33ng/ml, the predicted HbA1c value will be 5.3.

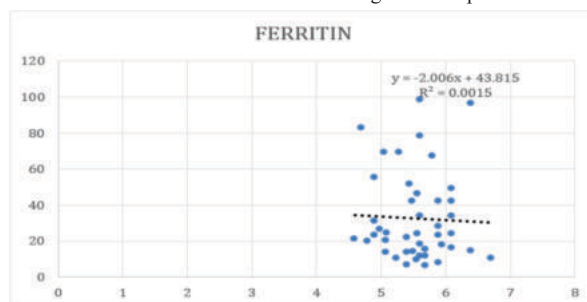


3.8: Graph 2: Correlation Of HbA1c And Ferritin for OGCT 120-140 (N=53)

The value of R is -0.1129.

Although technically a negative correlation, the relationship between these variables is only weak (*nb.* the nearer the value is to zero, the weaker the relationship).

The P-Value is 0.424612. The result is *not* significant at p < 0.05.



3.9 : Graph 3: Correlation Of HbA1c And Ferritin For OGCT 140-200mg/dl (N=44)

The value of R is -0.0393.

Although technically a negative correlation, the relationship between your variables is only weak (*nb.* the nearer the value is to zero, the weaker the relationship). The P-Value is .799222. The result is *not* significant at p < .05.

In summation, 100 women with deranged OGCT were chosen as per inclusion and exclusion criteria.

these women were divided into three categories based on OGCT levels according to DIPSI guidelines.

120-140 mg/dl: deranged gestational glucose tolerance
 141-200mg/dl: Gestational Diabetes Mellitus
 >200mg/dl: Overt Diabetes
 All these women underwent testing for HbA1c and Serum Ferritin.
 37% of these women were anemic (Hb<11g%)
 72% of these women had iron deficient status (Serum Ferritin<12 µl)
 these women were divided into 3 groups
 <12 µl: exclusive iron deficiency
 12-40 µl: mild/ moderate iron deficiency
 >40 µl: no iron deficiency

HbA1c testing was also done in these women. Of these women, 28% had HbA1c>5.7% (either prediabetic or diabetic range)

Relationship between HbA1c and Serum ferritin was studied in these women across all ranges. A negative relationship between HbA1c and Serum ferritin was found, although, its significance could not be established.

4. DISCUSSION

In our study population, we have found a negative correlation between HbA1c and Serum ferritin and conversely, HbA1c and iron deficient status. The significance of this relationship however could not be established. The same relationship was found when the data was studied in two separate groups, i.e., in women with OGCT between 120-140 mg/dl and in women with OGCT 140-200 mg/dl. Significance of relationship could not be established in either group. Since only 3 women were in the group with OGCT >200mg/dl i.e.; overt diabetes, the relationship could not be studied in this group.

In a similar study conducted in the non-pregnant population, Coban et al (8) studied the effect of iron deficiency anemia on HbA1c in non diabetic patients. They studied the HbA1c before and after treating the same patients for iron deficiency and observed HbA1c to decrease after iron deficiency was corrected. Balasubramanian et al (9) studied the effect of iron deficiency on HbA1c in patients who were not known cases of Diabetes vs those who were known cases of iron deficiency found significant increase in HbA1c in patients of iron deficiency as opposed to controls (non iron deficiency). Rajagopal et al (10) also found similar results in their study on non diabetics.

Brooks et al (11) studied the relationship of HbA1c and iron deficiency in diabetic patients (non- pregnant), and in another study in pregnant women, Jiskani et al (12) found strong correlation between iron deficiency anaemia and iron deficiency, as was also observed by Rafat et al,(13) who studied the relationship of HbA1c and serum ferritin in women with and without iron deficiency anemia in 1st, 2nd and third trimesters of pregnancy and also compared the results seen in pregnant women to those who were non anemic and non-pregnant, he found to have significant negative correlation between Hb and serum ferritin. They also found a significant difference between non anemic non-pregnant group and non diabetic anemic pregnant group of women.

Hashimoto et al (14) also found elevated HbA1c levels in iron deficient pregnant women who were known diabetics.

On the contrary, (15) Bindayel et al found HbA1c to have similar values in iron deficient vs non iron deficient pregnant women in a study conducted on Saudi Arabian women.

5. Limitations

There are no limitations to our study.

6. CONCLUSIONS

- HbA1c is negatively correlated with serum ferritin, but the significance of this relationship could not be established in our study.
- We would like to recommend undergoing OGCT screening early on the pregnancy, i.e., in the first trimester itself, regardless of presence or absence of risk factors to identify the at-risk population who are likely to develop higher than normal degree of insulin resistance later in pregnancy which can consecutively give rise to GDM and even identify unknown cases of type 2 diabetes mellitus as early as possible.
- Diagnosing of iron deficiency in pregnancy with serum ferritin

levels followed by its correction needs significant attention.

- HbA1c results are to be interpreted with caution in known diabetic women entering into pregnancy and having iron deficiency status.

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