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A Study of Relation between Iron Deficiency Anaemia and Glycosylated Haemoglobin in Non-Diabetic Patients.

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ABSTRACT

Background: Glycosylated hemoglobin (HbA1c) has been used as the gold standard for assessment of glycemic control and as a interpreter of complications caused by diabetic mellitus. Anaemia should be evaluated before reaching to any therapeutic decision individually on the basis of HbA1c levels. That is why the present study was designed to assess if there is any relation between iron deficiency and blood sugar level in non diabetic individuals. **Methods:** Sixty-nine patients were included in group I iron deficiency anaemia (IDA) patients for the study as they were diagnosed for IDA as well fulfilled the inclusion criteria of the study. Sixty-nine healthy subjects same age and sex matched were included in group II as control. **Results:** The HbA1c level was significantly high ($p<0.001$) in iron deficiency patients in comparison to control subjects. **Conclusion:** Results of the present study IDA is associated with high level of HbA1c, which may further leads to miss diagnosis of diabetes mellitus in IDA patients. Therefore, we strongly suggest that iron level must be evaluated along with HbA1c level in diabetic as well as non diabetic patients to avoid false picture of glycemic control.

Keywords: Anaemia, Iron deficiency anaemia, Glycosylated haemoglobin.

INTRODUCTION

Glycosylated hemoglobin (HbA1c) has been used as the gold standard for assessment of glycemic control and as a interpreter of complications caused by diabetic mellitus.[1] Iron deficiency is considered as one of the commonly prevalent forms of malnutrition. More than 50% of anaemia throughout the world is attributed due to iron deficiency. Iron is stored in human body in the form of ferritin which is the prominent marker of of the iron status.[2]

Glycohemoglobin is constantly produced by adding of glucose molecule on the N–terminal of the haemoglobin beta–chain throughout the circulatory life of red blood cell via a non-enzymatic process. This reflects the glycemic status of the subject over a period of two-three months. However, glycemic level is not only single factor to influence HbA1c, there are few other factors which are efficient enough to decrease the lifespan of red blood cell like sickle cell anaemia, blood loss acute or chronic, vitamin B12 deficiency, folic acid deficiency and pregnancy may remarkably decrease the HbA1c level.[3,4] However, despite the fact that iron deficiency is the commonest nutrition deficiency worldwide and in India. Nevertheless, clinically effects of iron deficiency on HbA1c have been not reported consistently.[5,6] Few studies have suggested that IDA leads to increase the level of HbA1c.[7,8] Anaemia should be evaluated before reaching to any therapeutic decision individually on the basis of HbA1c levels.[9] HbA1c is one of the most important markers and extensively used to evaluate the glycemic control. Therefore, it is necessary to identify the factors, which can falsely increase HbA1c level in individuals. That is why the present study was designed to assess if there is any relation between iron deficiency and blood sugar level in non-diabetic individuals.

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MATERIALS AND METHODS

The present cross sectional study was conducted in the Department of medicine of KD Medical College & Research Centre, Mathura. All the patients of age 18 years to 60 years suffering from IDA were recruited from the medicine ward of KD Medical College & Research Centre, Mathura. Total one hundred fifty-six cases diagnosed as anaemic according to WHO guidelines 10 among them sixty-nine patients were included in group I IDA patients for the study as they were diagnosed for IDA as well fulfilled the inclusion criteria of the study. Sixty-nine healthy subjects same age and sex matched were included in group II as control.

Inclusion Criteria included blood sugar level <70-110 mg/dl, Hb level for male <13 mg/dl for female <12 mg/dl, serum ferritin level for male <15 ng/ml for females <9ng/dl. Patients suffering from any type of chronic disease, on any type of medication and

with a history of acute or chronic blood loss were excluded from the study.

The informed written consents were taken from every participant before the study.

The venous blood samples (3ml) were collected empty stomach early in the morning. HbA1c were measured by using turbidimetric immunoinhibition method whereas, ferritin level were estimated by using diatek kits. Haemoglobin, mean corpuscular volume (MCV), hematocrit, mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC), were estimated by using an automated cell counter. AIA 360 Tosoh automated immunoassay analyser, RIPL - 5000 fully automated analyzer and cell counter were used for measurement of entire biochemical parameters.

Statistical Analysis

The data of the present study was expressed as mean ± SD. Student t- test was applied for comparison of both group values. Pearson's coefficient of correlation was used to evaluate the correlation between two variables. P value < 0.05 was considered statistically significant.

RESULTS

All the study participants of both groups were non diabetic. Findings of the present study revealed that serum ferritin level and haemoglobin level wer significantly low in group I patients in contrast to group II control subjects. Further, blood smear showed hypochromic microcytic red blood cell in group I. Table 1 shows that most of the IDA patients belong to 31 to 40 years age group. The mean age of group I population was 38.9±15.4 years while 39.23±16.1 years was for group II subjects. The p value was insignificant (p>0.05). The IDA was more common in females (69.6%) then on males (30.4%). (Table 2) Figure 1 shows that HbA1c level was significantly high (p<0.001) in iron deficiency patients in comparison to control subjects.

Table 1: Distribution of anaemia in both groups according to age.

Age	Group I No. of cases		Group II No. of cases	
<20	13	19%	14	20%
21-30	10	14%	10	14%
31-40	22	32%	22	32%
41-50	9	13%	8	13%
51-60	4	6%	4	6%
>60	11	12%	11	12%

Further [Table 3] shows all the IDA patients were suffering with fatigability on exertion (100%). Whereas, 55.9% patients were suffering with dyspnoea and 10.1% from fever. 13.01% and 15.9% of IDA patients complained about giddiness and palpitation respectively. [Table 3]

Table 2: Sex distribution in both groups.

Sex	Number of cases	Number of controls	% of patients
Males	21	21	30.4
Females	48	48	69.6
Total	69	69	100

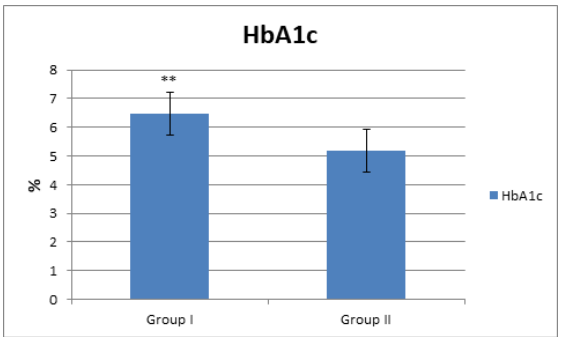

Figure 1: HbA1c in both groups

Table 3: Physical symptoms in group I patients.

Symptoms	Number of patients	% of total
Fatigability on exertion	69	100
Dyspnoea on exertion	38	55.07
Fever	7	10.1
Giddiness	9	13.01
Palpitation	11	15.9

Furthermore it is evident from [Table 4] that pallor tongue was found in all the IDA patients of group I. However, second most abundantly fond symptom was ejection systolic murmur (49.2%) followed by platynchia (47.8%). Further, IDA patients also showed sign of bald tongue (31.8%), pedal oedema (17.39%) and venous hum (15.9%).

Table 4: Clinical signs of anaemia in group I patients.

Signs	Number of patients	% of total
Pallor	69	100
Bald tongue	22	31.8
Platynychia	33	47.8
Pedal oedema	12	17.39
Ejection systolic murmur	34	49.2
Venous hum	11	15.9

It is evident from table 6 that anaemia 73.9% of IDA patients were suffering with severe anaemia 24.6% of IDA patients were suffering with moderate anaemia.

DISCUSSION

Finding of the present study have shown that HbA1c level was significantly high in IDA group I in comparison of group II control subjects which are consistent with the prior studies of Coban et al. 3 and

Gram-Hansen et al.[11] These findings are very similar to the findings of the previous study of Brooks et al.[7] in which they recorded the slimier high level of HbA1c in non-diabetic IDA patients. Similarly, Tarim et al recorded that HbA1c level was high in IDA patients with normal blood sugar level.[13]

Table 5: Comparison of hamoglobin in both groups

Hb (mg/dl)	Cases	Controls	p value
Male	7.82	14.2	<0.001*
Female	6.28	12.65	<0.001*
Total	6.43	12.49	<0.001*
Mean±SD	6.52±1.6	13.12±2.4	<0.001*

Table 6: Degree of anaemia in group I male and female patients.

Severity	Male %	Female %	Total
Severe <8	13	38	51
Moderate <8-10.9	7	10	17
Mild 11-11.9	1	0	1
Total	21	48	69

Various theories have been proposed by researcher for the higher level of HbA1c among them Sluiter et al suggested that react Hb1Ac reaction with RBC is irreversible on the other hand in IDA circulating age of RBC increased due to decrease rate of RBC formation.[14] Therefore HbA1c level is found high in IDA patients. Apart from this Brooks et al suggested that due to iron deficiency there is some alteration of Hb structure which further facilitates the glycation of Hb.[7]

DSiverse studies showed that there was significant decrease of HbA1c level after treating the iron deficiency in IDA patients. They suggested that blood sugar level is normal while Hb level is low it may have increase the glycation of Hb.[3,15] However, all the above theories are speculations and cause of higher level of HbA1c in IDA patients is still not clear.

CONCLUSION

Results of the present study IDA is associated with high level of HbA1c, which may further leads to miss diagnosis of diabetes mellitus in IDA patients. Therefore, we strongly suggest that iron level must be evaluated along with HbA1c level in diabetic as well as non diabetic patients to avoid false picture of glycemic control.

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