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TO STUDY THE IMPACT OF IRON DEFICIENCY ANEMIA ON HBA1C LEVELS IN NON-DIABETIC ADULTS

General Medicine

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ABSTRACT

Aim: To analyze the effect of iron deficiency anemia on glycated hemoglobin (HbA1c) in non diabetic Indians.
Material And Methods: 100 randomly selected non-diabetic patients with confirmed iron deficiency anemia were compared with 100 randomly selected cases without diabetes and without Iron deficiency anemia healthy adults.
Results: The mean HbA1c of cases was 5.89% while it was 5.01% in healthy control. Application of statistical test shows that the difference of HbA1c between case and control group was statistically significant ($p<0.01$) indicating statistically higher HbA1c in cases group.
Conclusion: Our results showed that iron deficiency was associated with higher proportions of HbA1c, which could cause problems in the diagnosis of uncontrolled diabetes mellitus in iron-deficient patients.

KEYWORDS

Non-Diabetic Patient, Glycosylated Hemoglobin, Iron Deficiency Anemia

INTRODUCTION:

Hemoglobin A1c (HbA1c) is a glycated hemoglobin that can be used as an indicator of a patient's glycemic status over the previous 3 months [1]. According to the American Diabetes Association (ADA) guidelines, the value of HbA1c should be kept below 6.5% in all the diabetics. The values which are greater than 7% indicate an increased chance of progression to the diabetic complications, especially the microvascular ones [2]. HbA1c levels are not affected by blood glucose levels alone. They are also altered in hemolytic anemias, hemoglobinopathies, acute and chronic blood loss, pregnancy and uremia, Vitamin B12, folate, and iron deficiency anemias have also been shown to affect HbA1c levels [3].

The two known factors which can modulate the glycation of proteins are the prevailing concentration of glucose and the half life of the protein [4]. But evidences in the literature have documented increased glycated protein levels in some non-diabetic pathological states, like iron deficiency anemia. Some authors have also found that on supplementation with iron therapy, there was a significant decrease in the levels of glycated haemoglobin [5].

Some studies show that HbA1c levels are increased in iron deficiency anemia and attempted to explain on the basis of both modifications to the structure of haemoglobin and level of HbA1c in old and new red blood cells [6]. Some Study showed that HbA1c levels were higher in patients of iron deficiency anemia and decreased significantly upon treatment with iron [7].

With this background, the objective of the present study was to study the effect of iron deficiency anemia on glycated hemoglobin (HbA1c) in non diabetic Indian subjects. If so, the iron deficiency had to be corrected before any diagnostic or therapeutic decision was made based on the HbA1c level.

MATERIALS AND METHODS:

200 subjects were divided into two groups of 100 each i.e. 100 randomly selected non-diabetic patients with confirmed iron deficiency anemia were compared with **100** randomly selected cases without diabetes and without Iron deficiency anemia healthy adults who attended the Medicine department at Muzaffarnagar Medical College and Hospital were included in the study, on the basis of strict inclusion and exclusion criteria. All the participants were also informed about the study procedure and the information required from them for the study. A voluntary informed written consent was taken from the participant those who consented were included in the study.

Inclusion Criteria

1.All consented Iron Deficiency Anemia patients with haemoglobin < 13.5 g/dl in males and <12.0 g/dl in females and ferritin less than 10 g /dl aattending Medical college OPD and wards in our hospital.
2. Normal fasting and postprandial plasma glucose levels
3. Normal blood urea and serum creatinine level

Exclusion Criteria

1) Pregnancy
2) Haemolytic anemia
3) Known case of Diabetic or Impaired glucose tolerance or fasting blood sugar >110mg/dl
4) Haemoglobinopathies
5) End stage kidney disease
6) End stage liver disease
7) Confirmed case of malignancies
8) History of blood transfusion in last 3 months

A detailed history like age, gender and clinical symptoms and examination was taken and physical examination was performed of the patients. The information regarding laboratory parameters like Hemoglobin, MCV, MCH, MCHC, TLC, Iron profile (serum iron,Total Iron Binding Capacity and serum ferritin), fasting blood sugar level, Random blood sugar level, HbA1c, liver and renal function tests were also noted.

Statistical Analysis:

The frequency distribution and graph were prepared for the variables. The P value and chi square test were used wherever appropriate to analyze the data and were calculated to find correlation between two variables. A $p<0.05$ was considered statistically significant.

RESULTS:

All cases and controls are non diabetic. In case group highest cases were in 18-30 years of age and in control group highest cases were in 18-30 years age group. The difference of age between case and control group was statistically non significant (table 1).

Table 1:- Comparison Of Age And Gender In Cases (IDA) And Control (healthy)

Age	Case (IDA)	Control (Healthy)	Total	P value
	No. (%)	No. (%)	No. (%)	
18-30 yrs	24 (24)	32 (32)	56 (28)	0.187
31-40 yrs	22 (22)	30 (30)	52 (26)	
41-50 yrs	27 (27)	21 (21)	48 (24)	
51-60 yrs	19 (19)	14 (14)	33 (16.50)	
61-65 yrs	8 (8)	3 (3)	11 (5.5)	
Male	33 (33)	44 (44.00)	77 (38.50)	0.109
Female	67 (67)	56 (56.00)	123 (61.50)	
Total	100 (100.00)	100 (100.00)	200 (100.00)	

The mean Hb in gm% of cases was 6.87 g% while it was 13.57 gm% in

healthy control. Application of statistical test shows that the difference of Hb between case and control group was statistically significant ($p<0.05$) indicating significantly higher hemoglobin level in control group compare to case group. The mean S. ferritin of cases was 7.60 ng/ml while it was 91.16 ng/ml in healthy control. Application of statistical test shows that the difference of S. ferritin between case and control group was statistically significant ($p<0.05$) indicating significantly lower S. ferritin level in case group compare to control group. The mean HbA1c of cases was 5.89% while it was 5.01% in healthy control. Application of statistical test shows that the difference of HbA1c between case and control group was statistically significant ($p<0.01$) indicating statistically higher HbA1c in cases group.

Table 2: Comparison of Hb, Serum Ferritin and HbA1C in Cases (IDA) and Control (Healthy)

Variable	Case (IDA)	Control (Healthy)
Hb in gm%, (Mean±SD)	6.87 ± 1.70	13.57 ± 0.75
P value*	<0.001	
S. Ferritin (ng/mL), (Mean±SD)	7.60 ± 2.43	91.16 ± 13.15
P value*	<0.001	
HbA1C, (Mean±SD)	5.89 ± 0.13	5.01 ± 0.17
P value*	<0.001	

*Calculated by using't' test. P value <0.001 very significant

DISCUSSION:

Our results suggested that IDA was associated with higher concentrations of HbA1c.The mean HbA1c of cases was 5.89% while it was 5.01% in healthy control. Application of statistical test shows that the difference of HbA1c between case and control group was statistically significant ($p<0.01$) indicating statistically higher HbA1c in cases group.

In the study conducted by Vishal Kalasker et al,[8] the mean HbA1c of cases was 5.91±0.47 % while it was 6.54±0.39 % in healthy control. Application of statistical test shows that the difference of HbA1c between case and control group was statistically significant ($p<0.01$) indicating statistically higher HbA1c in control group.

In the study conducted by Balasubramanian Shanthi et al [9], the mean HbA1c of cases was 7.6 ± 0.5% while it was 5.5 ± 0.8 % in healthy control. Application of statistical test shows that the difference of HbA1c between case and control group was statistically significant ($p<0.01$) indicating statistically higher HbA1c in cases group.

In the study conducted by Alap L. Christy et al [10], the mean HbA1c of cases was 6.87 ± 1.4% while it was 5.65 ± 0.69% in healthy control. Application of statistical test shows that the difference of HbA1c between case and control group was statistically significant ($p<0.01$) indicating statistically higher HbA1c in cases group.

Hansen et al [11], showed normal HbA1c concentrations in iron deficiency, which dropped to subnormal levels after iron supplementation. Rai et al [12], investigated the different methods and no difference was detected among the colorimetric methods, ion-exchange chromatography and affinity chromatography.

Our results suggested that IDA was associated with higher concentrations of HbA1c. Similarly, Brooks et al [13], showed higher HbA1c concentrations in iron-deficient nondiabetic adults, which decreased to normal. In anaemic patients, the concentration of glycated haemoglobin has been reported to be increased despite the shortened life span of the erythrocytes. Several mechanisms have been advocated for this increase in the levels of glycated haemoglobin in anaemic patients. It has been proposed that in iron deficiency, the quaternary structure of the haemoglobin molecule may be altered, and that the glycation of the β-globin chains occurs more readily.

This study has got a significant relevance because iron deficiency anemia is very highly prevalent in a tropical country like India.. HbA1c is commonly used to assess the long-term blood glucose control in the patients with diabetes mellitus[14].

CONCLUSION:

Our results showed that iron deficiency was associated with higher proportions of HbA1c, which could cause problems in the diagnosis of uncontrolled diabetes mellitus in iron-deficient patients. The iron status must be considered during the interpretation of the HbA1c concentrations in Diabetes mellitus. The iron replacement therapy is thus especially important in diabetic patients with iron deficiency, as it would also increase the reliability of the HbA1c determinations.

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