

Study of Glycosylated Hemoglobin Levels in Iron Deficiency Anemia

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Abstract

The aim of present study was to study the levels and analyze the variation in glycosylated hemoglobin (HbA1c) levels in Iron Deficiency Anemia (IDA). This study was conducted on 50 cases who were diagnosed to be having iron deficiency anemia and 50 age matched healthy controls which are not having any form of anemia. The levels of HbA1c was significant increased in cases of iron deficiency anemia as compared to those in the healthy controls. There were no differences in the random glucose levels between the anemic and healthy subjects. It is not only the blood sugar levels that affects HbA1c levels but it also may be affected by other factors such as hemoglobinopathies and anemia among which most common in India is iron deficiency anemia. Hence, it very vital to be have an estimate of iron levels in the blood so as to be able to take therapeutic decision to treat diabetes based on HbA1c levels. Therefore, it is always advisable to correct any iron deficiency before any diagnostic or therapeutic decision is made.

Keywords: Glycosylated Hemoglobin; HbA1c; Iron Deficiency Anemia; Diabetes Mellitus.

Introduction

Glycosylated hemoglobin is used in clinical practice for having an estimate of glycemic control of last 2-3 months [1]. It is not only the blood sugar levels that affects HbA1c levels but it also may be affected by other factors such as hemolytic anemias [2], hemoglobinopathies, acute and chronic blood loss [3] pregnancy [4], and uremia [5]. Vitamin B₁₂, folate. Apart from this most common cause of anemia in India which is iron deficiency anemia have also been found to affect HbA1c levels. Iron deficiency anemia is the most common form of anemia in India [6]. One can label a subject as suffering from iron deficiency anemia if there is presence of atleast two following parameters

which can also be called as indicators such as serum ferritin, transferrin saturation, total iron binding capacity and peripheral blood smear picture of microcytic hypochromic anemia [7]. There had been different research studies which elaborated on relationship between iron deficiency anemia and HbA1c. These were Brooks *et al.* [8] Sluiter *et al.* [9] and Mitchell *et al.* [10] who reported positive correlation between changes in iron levels and HbA1C variations. However, there were some researchers who contradicted with researchers mentioned above and these were Von Heyningen *et al.* [11] and Gram-Hansen *et al.* [12] But there were other studies have shown that reduced iron levels were associated with increased levels of HbA1c [8]. In spite of iron deficiency anemia being the most common nutritional anemia there have been many evidences of inconsistency in relation of iron and HbA1c levels [13].

Since the earlier results on the relation between HbA1c and iron deficiency anemia were inconsistent and the exact mechanism remained

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unclear, we have attempted to perform this study to investigate the effects of Iron Deficiency anemia on HbA1c levels.

Material and Methods

We conducted this study at GMC; Aurangabad in department of pathology during January 2016 to May 2017. 5ml blood samples were obtained by venepuncture from 50 anaemic patients aging 45±5 years, and 50 age-matched healthy controls. Among the iron deficiency anemia group 18 were males and 32 were females. The study subjects were enrolled from the medicine outpatient department

of our institute. All the study subjects (cases & controls) underwent following investigations; blood hemoglobin (Hb) concentration, CBC, serum ferritin and TIBC, PS, random blood glucose and glycosylated hemoglobin. The HbA1c levels were determined by sysmex HbA1c analyser. The peripheral blood smears were examined in all the patients. Estimation of blood sugar was done on fully automated transasiaautoanalyser. Patients having diabetes mellitus and any type of hemoglobinopathies were excluded from our study. All the results were presented as mean± S.D. Significant differences were evaluated using students t-test when $p \leq 0.05$.

Table 1:

Sr.No	Parameters	Normal Subjects (n = 50) Mean ± S.D.	IDA subjects(n = 50) Mean ± S.D.	Significance
1.	Hb(gm/dl)	12.66 ±0.42	9.17 ±1.84	$p < 0.001$
2.	Serum Ferritin	0.08 ±0.76	0.06±0.01	$p < 0.001$
3.	TIBC	0.42 ±0.16	0.56 ±0.03	$p < 0.001$
4.	Glycosylated Hb	5.3 ±0.09	6.4 ±0.72	$p < 0.001$
5.	Random Glucose	124 ± 7.68	130± 4.71	$p > 0.05$

All the parameters which were tested in both the groups have been reported in table above. The peripheral blood smears showed a microcytic hypochromic picture. The HbA1c levels were significantly increased among the iron deficiency

Observation & Results

anemia patients as compared to those in the controls. There were no differences in the levels of random glucose levels between the subjects of iron deficiency anemia and the control groups ($p > 0.05$).

Discussion

In the present study it was observed that HbA1c concentrations were found to be higher in the subjects with iron deficiency. Our study results were consistent with one of the study reported in past by Brooks et al. [8] who analyzed HbA1C levels in 35 non-diabetic patients having iron deficiency anemia both before and after treatment with iron. They concluded that HbA1C levels in subjects with iron deficiency anemia were significantly higher as compared to healthy controls. They also reported that HbA1C levels decreased when the subjects were treated with iron supplements. They postulated the following mechanism of increase in HbA1c levels in iron deficiency anemia subjects in which they stated that, iron deficiency resulted in alteration of the structure of the hemoglobin molecule and it also led to rapid glycation of the globin chain as compared to normal scenario [8]. Another study reported by Sluiter et al. [9] attempted to justify the rising trend of Hba1c in iron deficiency anemia in which they proposed that there is linear relationship between HbA1c

concentration and RBC age. They also reported that in iron deficiency anemia although the formation rate of RBC decreases but there is increase in average lifespan of circulating erythrocytes so it ultimately results in more glycation and thus levels of HbA1c rises [9]. Some other researchers also agreed with the studies done by Brooks et al and Sluiter et al such as studies by El-Agouza et al. [14] and Cogan et al. [15] who in their respective study concluded that in iron deficiency anemia resulted in significantly increased levels of HbA1C and also reported that these increased Hba1c levels normalized after treatment with iron supplements. They tried to justify their observation by arguing that elevated HbA1c levels in iron deficiency anemia could be explained by the assumption that if serum glucose remains constant, a decrease in the hemoglobin concentration might lead to an increase in the glycated fraction. In contradiction to above mentioned studies there were some researchers who reported otherwise. Among them first study conducted was by Mitchell et al. [10] who analyzed the absolute concentration of HbA1c in each erythrocyte and concluded that HbA1c levels before and after iron treatment did not change.

They also studied research work done by Sluiter et al. and commented that erythrocyte lifespan was unlikely to be a significant factor in explaining the changes in HbA1c levels in iron deficiency anemia. As evident from the above studies, the exact mechanism through which iron deficiency anemia affects HbA1c levels still remains unclear. But we support the theories postulated by Brooks et al and Sluiter et al as we find factors mentioned above in their respective studies more logical reasoning for increased levels of HbA1c in subjects of iron deficiency anemia.

Conclusion

HbA1c levels were significantly increased in subjects having iron deficiency anemia.

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