



IMPACT OF IRON DEFICIENCY ANEMIA ON HEMOGLOBIN A1C LEVEL AMONG SUDANESE PATIENTS

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ABSTRACT

Background: Iron deficiency anemia is the most occurring form of anemia in Sudan. Hemoglobin A1c (HbA1c) is used in diabetic patients as a marker to reflect glucose levels of the last 3 months. Like blood sugar levels HbA1c levels are also affected by presence of variant hemoglobin, hemolytic anemia, nutritional anemia's, uremia, pregnancy and acute blood loss. However, reports on the effects of iron deficiency anemia on HbA1c levels are inconsistent. We conducted this a study to analyze the effects of iron deficiency anemia on HbA1c levels. **Objectives:** The aim of this study the impact of iron deficiency anemia on hemoglobin A1c level among Sudanese patients. **Methods:** Cross sectional case control study Fifty patients confirmed to have iron deficiency anemia were enrolled in the study. These values were also compared with those in the control population. **Results:** The mean baseline of HbA1c level in anemic patients (7.10) was significantly higher than that of controls (3.9). **Conclusion:** Iron deficiency anemia has a direct correlation with HbA1c levels and the relationship is in verse between them. This signifies that as the level of hemoglobin drops with increasing severity of iron deficiency in anemic subjects, at the same time HbA1c levels increase correspondingly. Moreover, with correction of iron deficiency in the anemic subjects, the HbA1c levels decline to near normal values. Other than blood glucose, many other factors values. Iron deficiency anemia being extremely common in Sudan settings should always be ruled out when high HbA1c levels are detected and should be corrected on priority to achieve true levels of HbA1c.

KEYWORDS: Iron deficiency anemia, Diabetes mellitus, Hemoglobin A1c.

INTRODUCTION

Hemoglobin A1c (HbA1c) is a glycosylated hemoglobin that is used as an indicator of a patient's glycemic status over the previous three months.^[1] According to the recent American Diabetes Association Guidelines, HbA1c levels should be maintained below 7% in all diabetic patients in order to prevent the development of microvascular complications.^[2] Also as per the recent recommendations by the IDF and AACE, the optimum level at which HbA1c should be maintained in diabetics has been brought down to the target of 6.5%. HbA1c levels are not affected by blood glucose alone. They are also altered in hemolytic anemia's^[3], hemoglobinopathies^[4], acute and chronic blood loss^[5,6], pregnancy^[7,9] and uremia.^[10,12] Vitamin B12, folate and iron deficiency anemia have also been shown to affect HbA1c levels. Iron deficiency anemia is the most common form of anemia observed in Indian settings^[13] and India being the diabetes capital of the world, it was imperative to find out the relationship that exists between iron deficiency anemia and HbA1c which is one of the

commonest investigation carried out routinely in diabetic patients. Initial studies done on the association of Iron deficiency anemia with HbA1c levels by Brooks et al.^[14] Sluiter et al.^[15] and Mitchell et al.^[16] revealed a relationship between them existed and attempted to explain the alteration in HbA1c levels in iron deficiency anemia on the basis of both modifications to the structure of hemoglobin and levels of HbA1c in old and new red blood cells. Later, Heyningen et al.^[17] and Hansen et al.^[18] reported that there were no differences between the HbA1c levels of anemic patients and controls. Rai et al.^[19] investigated different methods to assay HbA1c levels and found no differences in HbA1c levels detected when using calorimetric assays, ion exchange chromatography and affinity chromatography. An Indian study done by Nitin et al.^[20] came out with the results that iron deficiency anemia and HbA1c levels were directly proportional and both of them increased or decreased in the same direction. The matter of the fact is that this entity called HbA1c is not just about diabetes and blood glucose control; rather it is affected by

multiple factors. Iron deficiency anemia being every common co morbidity found in Indian population itself impacts a person’s HbA1c level and its correction bring its level back to normal. So it becomes prudent to show the effect of iron deficiency anemia on HbA1c levels before any decision or guide lines are made based on HbA1c levels.

The results of all studies done previously on this topic are conflicting and the exact mechanism as well as relationship between iron deficiency anemia on HbA1c levels is not yet known. Therefore, both because of this lack of corresponding evidence and since no conclusive studies exist for this topic, we were prompted to conduct the current study to investigate the effects of Iron Deficiency Anemia on HbA1c levels in Sudan patients.

MATERIALS AND METHODS

50 confirmed cases of iron deficiency anemia with Hemoglobin <3.5 mg/dl in women and <10 mg/dl in men were included in study group and Iron deficiency was confirmed Patients with history of acute blood loss, hemolytic anemia, hemoglobin apathies, kidney disease, pregnancy, established diabetes, impaired fasting glucose or impaired glucose tolerance were excluded from the study. Even patients with no history of glucose intolerance but with fasting blood glucose >100 mg/dl at the time of enrolment were excluded. Women of child bearing age who have amenorrhea and those with reticulocyte count more than 2.5 or blood urea greater than 40 were also excluded from the study. 30 healthy and matched controls were included for comparison. However, exclusion criteria for controls were same as that for patients. All the patients enrolled in the study were from outdoor and indoor departments of a Polyclinic and Institute of Medical Sciences, Luck now and a written informed consent was taken from all before enrolment. The data was presented as mean (SD) for continuous variables. A student’s test was applied for comparison of group means. Pearson’s coefficient of correlation was calculated to find correlation between two variables. A p<0.05 was considered statistically significant.

RESULTS

Of the 50 patients in study group, there were 33 females (66%) as compared 20 (40%) in the controls. This

Table (2): Descriptive Statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
Hb g/dl	80	3.50	15.20	9.0088	3.75106
HbA1c %	80	2.20	7.90	5.9025	1.74196

DISCUSSION

Iron deficiency anemia is most common form of anemia observed in our country. HbA1c is one of the glycosylated hemoglobin’s which is used to assess the glycemic status of an individual over last 2 to 3 months and is mostly being used in diabetics and in those with impaired

suggests that iron deficiency is commoner among females. The mean age of patients in study group was 30.3 years as compared to 36.24 years in controls. The minimum age in patients in study group was 12 years and maximum age was 50 years.

This observation goes on to suggest that iron deficiency is seen more commonly among vegetarians.

As shown in (Table 1), the mean level of hemoglobin A1c showed significant increased in iron deficiency anemia patients when compared with healthy individuals (P. value = 0.003).

Table and figure (1) comparison the level of hemoglobin A1c and hemoglobin between patients and control.

	Patient no.50	Control no.30	p-value
Hb (g/dl)	6.36±1.7	13.4±1.0	.003
HA1c%	7.10±.58	3.9±1.0	.000

Result expressed as mean ± SD.

Significant different concenter as P – value ≤ 0.05.

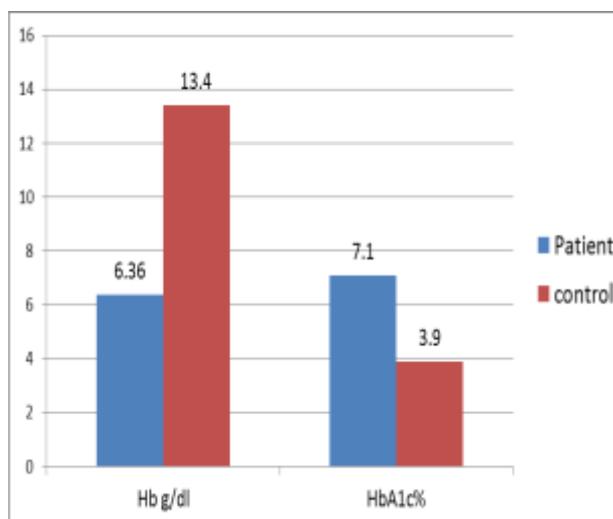


Figure (2)

There was significant increased of Hb1cA level in iron deficiency anemia patients when compared to control groups with p-value (0.003) and (0.000) respectively.

number of variable explanations available to explain these findings. We used accepted methodology A1C by fluorescence immunoassay (I chrome) in estimating HbA1c and the analysis was validated in our laboratory. A strict quality control was ensured and samples were tested in assorted manner i.e. the controls and the tests were not analyzed in separate batches but mixed batches were the rule during the period of study. Iron deficiency anemia has a straight forward correlation with HbA1c levels and the relationship is inverse between them. This signifies that as the level of hemoglobin drops with increasing severity of iron deficiency in anemic subjects, at the same time HbA1c levels increase correspondingly. Moreover, with correction of iron deficiency in the anemic subjects, the HbA1c levels decline to near normal values. This concludes that whenever HbA1c is calculated to detect past three months glycemic status, factors other than glucose also play a part in its calculated value. Iron deficiency anemia being extremely common in Sudan settings should always be ruled out when high HbA1c levels are detected and should be corrected on priority to achieve true levels of HbA1c. Sudan being the diabetic capital of the world and HbA1c being such a common investigation in day to day medical practice, should always be interpreted carefully keeping in mind all the factors affecting its value including some very common ones like iron deficiency anemia. The reason behind this correlation between iron deficiency anemia and HbA1c is still not clear and various theories exist to explain this. However more large scale studies are required to find out the proper mechanism underlying this correlation.

CONCLUSIONS

The present study concluded that, increase the level of HbA1c in iron deficiency anemia patients when compared to normal healthy individual.

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