Original Research Article

Correlation between iron deficiency anemia and HbA1C levels in type 2 diabetes mellitus

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ABSTRACT

Introduction: The HbA1c levels, in general reflects the diabetic patients Glycaemic control status over the previous 3 months. HbA_{1C} concentrations may be increased by Anaemia due to iron deficiency, independent of glycaemia in diabetic patients. Henceforth this study serves to find if there is a positive correlation between the iron deficiency anaemia status & the HbA1c levels amidst the diabetic population.

Materials and Methods: Cases-100 iron-deficiency anaemia patients with diabetes having controlled plasma glucose levels, Controls -100 non-anaemic diabetic individuals. The study was done in the premises of Sree Balaji Medical College & Hospital. HbA_{1c} levels was measured by ion exchange chromatography, ferritin by particle enhanced turbidometric immunoassay method, fasting plasma glucose by GOD - POD method.

Results: We found that HbA1c was elevated (7.3±0.9) in iron-deficient diabetic individuals compared to normal level (5.4±0.6) in controls.

Conclusion: The study showed that there was a positive correlation between the iron deficiency anaemia status and increased HbA_{1c} levels in the controlled diabetic population. Hence forth, the clinical significance of evaluating the iron deficiency anaemia status in diabetic patients has been proved to be significant in planning their further course of prompt diabetic management.

1. Introduction

Among the various known anaemia's in India, Iron deficiency anaemia is more commonly encountered in both the urban and the rural forms of our society. The most common cause of this is under nutrition particularly amidst females. 50% of anaemia is attributed to iron deficiency, worldwide. The iron status in our body is precisely and accurately predicted by the ferritin levels (iron storage form).[1] Various previous studies have proved that, depleted iron status, tend to have a link with the deranged (increased) glycation of haemoglobin (HbA_{1c}) levels. HbA_{1c} is suggestive of the glycated haemoglobin content that is widely used as an indicator of a patient's glycaemic status over the previous 3 months.[2] HbA_{1c} levels act as the most accurate indicator of the individual's diabetic status globally. According to the standards set by the American Diabetes Association Guidelines, HbA_{1c} levels below 7% in an diabetic patient, is termed as good control, that keeps them safe from the developing various life threatening micro vascular complications associated with diabetes.[3] Certain haematological factors like the haemolytic anaemia's,[4] hemoglobinopathies, and acute and chronic blood loss also have a significant impact on the HbA_{1c} levels besides pregnancy and uraemia. HbA_{1c} levels in the body may also be influenced/altered by various other minor factors like Vitamin B12 & folate levels in addition to the iron deficiency anaemia status. Henceforth in this study we aimed to correlate the significance of estimating the iron deficiency status along with the HbA1c levels, in our study's diabetic population.

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2. Materials and Methods

The study was done in the Medicine department in association with the Central laboratory, in the premises of, Sree Balaji Medical College & Hospital, chromepet Chennai. The study chiefly consisted of 200 subjects consisting of 100 cases and 100 controls:

1. Cases-100 iron deficiency anaemia patients with diabetes having controlled plasma glucose levels,
2. Controls -100 non anaemic diabetic individuals.
3. Ion exchange chromatography – used to measure the HbA1c levels.
4. Particle enhanced turbidometric immunoassay method – used to measure ferritin levels
5. GOD – POD method – to measure fasting blood glucose levels.
6. Haemoglobin, peripheral smear examination, red cell indices, and medical history were all recorded.

3. Results

Table 1:

Parameters	Patients	Controls
Haemoglobin	6.0±3.1	13.0±0.5
Serum ferritin(ng/ml)	6.5±3.5	235±75.5
$HbA_{1c}\%$	7.3±0.9	5.4±0.6

7.3% was the mean HbA_{1c} levels in the anaemic patients, while that in the controls was 5.4% which is significant. (p<0.01).

4. Discussion

This is a typical case control study organised and conducted in the premises of Sree Balaji Medical College & Hospital. The most common fraction of HbA_1 is HbA_{1c}. HbA_{1c} is predominantly formed by the interaction of Glucose with the N-terminal valine groups of both the beta chains, to form an aldimine linkage that ultimately realigns itself to form the stable ketoamine link of HbA_{1c}.[5,6] HbA_{1c} is a globally acknowledged significant criteria, for diagnosing, treating and to overview the prognosis of the diabetic patients, in accordance with the American Diabetic Association. HbA_{1c} levels in the body may also be influenced/altered by various other common haematological conditions like;[7–9] haemolytic anaemia's, acute and chronic blood loss, etc. Pregnancy and uraemia also have a significant impact on HbA_{1c} levels.[2,10,11]

For decades, both the urban and the rural population of India have encountered varying degrees of Iron deficiency anaemia. In accordance with various global studies it was proved that iron therapy proved to be beneficial in maintaining a well-controlled glycated haemoglobin level.

There was a significant decrease in HbA1c levels after iron therapy even in the non-diabetic population to some extent.[2,12,13] In the erythrocytes as the age advances, the HbA_1 levels also tend to increase.[14] This age related haemoglobin glycation process is of an irreversible type. As we age there is also a depletion in the production of RBC that is concomitantly accompanied by an increased age of circulating red cells with increased HbA_1 levels.[14]

In our study it was scientifically proved that the elevated HbA_{1c} levelswere caused significantly due to the iron deficiency status. Although the HbA_{1c} levels are generally higher in the diabetic patients, patients with controlled plasma glucose levels for 3 months are generally expected to have HbA1c level below 6.5%[4]

The results showed that, the HbA_{1c} levels were significantly elevated in iron-deficient anaemic individuals with FPG less than 130. The importance of HbA_{1c} as an important prognostic marker has been established by various other studies carried out in diabetic individuals.[10,15,16] From this study the positive correlation between iron deficiency anaemia and elevated HbA_{1c} levels have been scientifically proved, that should always be considered before altering diabetic treatment regimen. Iron is stored chiefly in the body in the form of ferritin, its storage form that is highly suggestive, of the iron load status in the body.[1]

Increased RBC life span with concomitantly increased HbA_{1c} levels and decreased ferritin levels are encountered in most of the cases of iron deficiency anaemia. Previous studies have enhanced the fact, that with iron therapy there tends to be a clinically significant decrease in the elevated HbA_{1c} values of diabetic patients with iron deficiency anaemia.[2] Iron therapy also showed improvement (i.e. decrease) in the previously increased HbA_{1c} status of pregnant women with diabetes and diabetic CKD (chronic kidney disease) patients who were suffering with iron deficiency anaemia.[10,11] Thus it was concluded that the HbA_{1c} levels in diabetic patients was generally elevated when they had iron deficiency status, when compared with iron-sufficient controls. HbA_{1c} continues to be the most simple yet a significant marker for glycaemic control estimation. Thus the various other factors that tend to elevate the HbA_{1c} levels, should also be excluded and accounted for, before planning the further course of management in a diabetic patient.

5. Conclusion

Henceforth this study, scientifically and statistically proved the positive correlation between the iron deficiency anaemia status and the increased HbA1c levels in the controlled diabetic individuals. Thereby insisting the diabetic population to periodically check their iron status too, that has the potency to influence their HbA1c parameter used to assess the degree of their glycaemic control before

planning the course of management for the diabetes cases.

6. Source of Funding

None.

7. Conflict of Interest

None.

8. Acknowledgement

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