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Original Research Article

To Assess the Relationship Between Iron Deficiency Anemia and Blood Sugar Levels in Non-Diabetic Patients: An Institutional Based Study

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ABSTRACT

Background: To Study the Influence of Iron Deficiency Anaemia on Hba1c in Non-Diabetic Patients Glycated haemoglobin, HbA1c is the "gold standard" for monitoring glycaemic control. The present study was conducted to assess the relation between iron deficiency anemia and blood sugar levels in non-diabetic patients.

Materials and Methods: The present study was carried among adult patients who were screened for anemia as defined by WHO guidelines over a period of about 1-year. A detailed history was taken and physical examination was done. Blood samples were obtained from 110 anaemic patients and 110 healthy subjects. All collected sample were analysed for complete blood count (CBC), Diabetic profile (FBS, PP2BS) and HbA1c. The peripheral blood smears were examined in all the patients.

Results: In the present 110 participants were in test group and 110 participants were in control group. The fasting and the postprandial blood glucose levels confirmed the non-diabetic status. The HbA1c levels were significantly increased among the test group patients as compared to those in the controls. The mean HbA1c (9.2 ± 1.3%) level in the patients with test group was higher than that in the control group (5.2 ± 1.1%).

Conclusion: This study concluded that HbA1c levels were significantly increased among the anaemic patients as compared to those in the non-anaemic group.

Keywords: Iron Deficiency Anaemia, HbA1c, Non-Diabetic, Glycated Haemoglobin.

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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] Haemoglobin A1c (HbA1c) is a glycated haemoglobin that is used as an indicator of a patient's glycaemic status over the previous three months.2 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.[3] An earlier study showed that reduced iron stores have a link with increased HbA1c, leading to false-high values of HbA1c in non-diabetic individuals.[4] HbA1c is the most predominant fraction of HbA1, and it is formed by the glycation of terminal valine at the β-chain of Hb.[5] Logistically, HbA1c requires a non-fasting random sample and is more advantageous compared to conventional oral glucose tolerance test, which requires a fasting sample.[6] According to the American Diabetes Association (ADA) guidelines, the value of HbA1c should be kept below 7% in all the diabetics.[3] The values which are greater than 7% indicate an increased chance of progression to the diabetic complications, especially the microvascular ones. When plasma glucose is consistently elevated, the nonenzymatic glycation of haemoglobin increases; this alteration reflects the glycaemic history over the previous 2–3 months, since erythrocytes have an average lifespan of 120 days.[7] The present study was conducted to assess the relation between iron deficiency anemia and blood sugar level in non-diabetic patients.

MATERIALS AND METHODS

The present study was carried in Department of General Medicine, Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinna Avutapalli, Vijayawada, Andhra Pradesh (India) among adult patients who were screened for

anaemia as defined by WHO guidelines over a period of about 1 year. Before the commencement of the study ethical approval was taken from the Ethical Committee of the institute. A total of 110 cases were diagnosed to have iron deficiency anemia.

Patients with presence of anemia as defined by WHO Hb: <13g/dl (adult males), <12g/dl (non-pregnant women), Microcytic, hypochromic picture in peripheral blood smear, Serum ferritin: <9 ng/ml (in females), <15 ng/ml (in males) suggestive of iron deficiency, normal fasting and postprandial plasma glucose level, Normal liver function tests, Normal blood urea, serum creatinine levels were included in the study. The following patients were excluded from this study, those with Glucose tolerance abnormalities (impaired glucose tolerance or DM), Hemoglobinopathies, Hemolytic anemia, Chronic alcohol ingestion, chronic renal failure, Pregnant females and History of blood transfusion in the past 3 months.

A detailed history was taken and physical examination was done. The blood specimens were drawn after an overnight fast. Blood samples were obtained from 110 anaemic patients and 110 healthy subjects. Venous blood samples (3 ml) were drawn; 0.5 ml was taken into an EDTA-treated tube. All collected sample were analysed for complete blood count (CBC), Diabetic profile (FBS, PP2BS) and HbA1c. The peripheral blood smears were examined in all the patients.

The collected data was entered in Microsoft Excel spreadsheet and analysed using Statistical Package for Social Sciences (SPSS) version 17.

RESULTS

In the present 110 participants were in test group and 110 participants were in control group. The fasting and the postprandial blood glucose levels confirmed the non-diabetic status. The HbA1c levels were significantly increased among the test group patients as compared to those in the controls. The mean HbA1c (9.2 ± 1.3%) level in the patients with test group was higher than that in the control group (5.2 ± 1.1%).

Table 1: Laboratory data of study group.

Variables	Test group (n=110)	Control group(n=110)	P-value
Hemoglobin gm/dl	9.7±1.2	12.6±1.4	<0.05
PCV %	29.4±3.9	43.7±1.9	
MCV fl	77.5±4.2	81.8±3.5	
MCH pg	25.6±1.9	33.8±2.1	
Fasting blood Glucose mg/dl	95.5±8.4	91.2±8.7	
Postprandial blood sugar Mg/dl	115.3±5.5	117.2±4.9	
HbA1C %	9.2±1.3	5.2±1.1	

DISCUSSION

HbA1c is the most frequently occurring fraction of hemoglobin A1. In the process of glycation, glucose in the red cells reacts with N-terminal valine of both beta chains to form an aldimine linkage which undergoes rearrangement forming a more stable ketoamine link.[8,9] American Diabetes Association guidelines have not only considered it as the primary target for glycaemic control but also included it as a diagnostic criterion. Initially, it was believed that HbA1c was only altered by glucose levels[10-12]; however, certain studies have noted its elevation in conditions other than diabetes, such as hemoglobinopathies, chronic kidney diseases, pregnancy, and nutritional anemias.[4,13,14]

In the present 110 participants were in test group and 110 participants were in control group. The fasting and the postprandial blood glucose levels confirmed the non-diabetic status. The HbA1c levels were significantly increased among the test group patients as compared to those in the controls. The mean HbA1c (9.2 ± 1.3%) level in the patients with test group was higher than that in the control group (5.2 ± 1.1%).

Brooks et al. showed that HbA1c levels were higher in patients of iron deficiency anemia at baseline and decreased on treatment. The reason speculated by them was that the quaternary structure of haemoglobin gets altered and that, glycation of beta globin chain occurs more readily in the relative absence of iron.[4]

Heyningen et al. demonstrated that there was no difference seen in HbA1c (%) values at baseline and after treatment in iron deficiency anemia patients and speculated that the differences observed previously could be due to different methods used in calculating HbA1c.[15]

Gram-Hansen et al. showed normal HbA1c concentrations in iron defi ciency, which dropped to subnormal levels after iron supplementation.[16] Coban et al. found that among non-diabetic adults with iron-deficiency anemia, the A1c was 7.4% ± 0.3% before treatment and 6.2% ± 0.6% after treatment.[17]

Tarim et al. found that HbA1c in iron deficient patients decreased from 7.6% ± 2.6% to 6.2% ± 1.4% after iron therapy ($P < 0.05$), despite similar glucose levels.[18]

Saudek et al considered measurements of HbA1c to be invalid in the presence of anemia.[19]

CONCLUSION

This study concluded that HbA1c levels were significantly increased among the anaemic patients as compared to those in the non-anaemic group.

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