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Original Research Article

Evaluation of glycosylated hemoglobin levels in hypothyroidism after thyroxine replacement

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Abstract

Introduction: After diabetes mellitus, thyroid diseases are the second most frequent endocrine system disorders in the general population. The most prevalent type of glycated haemoglobin is haemoglobin A1C (HbA1c). HbA1c levels are influenced by factors that affect erythrocyte turnover or survival as well as the current glycemia, leading to values of HbA1c that are artificially high or low. Both the American Diabetes Association (ADA) and the World Health Organization have approved the use of HbA1c for the detection and treatment of diabetes.
Material and Materials: The prospective study includes 100 subjects diagnosed with hypothyroidism, Blood sample (random) was taken from each individual and parameters like Complete blood count, reticulocyte count, fasting blood glucose, post prandial blood glucose, HBA1C, TSH, and T4 were determined by spectrophotometric and by using Biochemistry Fully Automated Analyser.
Results: The mean age of the participants observed in the present study was found to be 43.23; The mean FBS values were raised significantly in the post treatment period. The mean value of HbA1C decreased significantly after treatment when compared to the pre-treatment levels.
Conclusion: To conclude, the findings of the study, HbA1c levels in patients with hypothyroidism are falsely elevated out of proportion to their level of glycemia, resulting in a false diagnosis of dysglycemia. However, after thyroxine replacement and the achievement of a euthyroidal state, HbA1c levels are lowered without any change in blood sugar levels.

Keywords: Blood sugar, thyroxine, HbA1C, TSH, T4

Introduction

HbA1c has been approved for diabetes screening and diagnosis by both the American Diabetes Association (ADA) and the World Health Organization (WHO). Both organisations have recommended that an HbA1c level of 6.5 percent be considered diabetes, while the ADA has also recommended that an HbA1c level of 5.7 to 6.4 percent be considered diagnostic of pre-diabetes [1-3].
Haemoglobin A1c is the most common form of glycated haemoglobin (HbA1c).HbA1c levels are influenced not only by the current glycemia, but also by the erythrocyte life duration and

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therefore by factors that impact erythrocyte turnover or survival, resulting in falsely high or low HbA1c readings [4, 5].

Even if diabetes is absent, Kim MK and co-workers [6] discovered that hypothyroid individuals had a falsely elevated HbA1c. Hypothyroidism causes a decrease in glucose-induced insulin secretion by beta cells, whereas hyperthyroidism causes an increase in beta cell response to glucose or catecholamine due to increased beta cell mass. Furthermore, in thyrotoxicosis, insulin clearance is increased [7, 8]. It was reported that HbA1c levels are increased in both hypothyroid and hyperthyroid patients [9].

The rise in HbA1c in both illnesses could be attributed to the distinct activities of thyroid hormones on the liver, skeletal muscles, and adipose tissue [10]. In hypothyroidism, decreased absorption and conversely decreased utilisation of glucose is associated with hyperinsulinemia and insulin resistance, most likely causing transient elevations in glucose concentrations and thus contributing to serum protein glycation [11]. Insulin resistance causes elevated glucose levels in hypothyroid individuals [12].

Other factors, such as RBC turnover, can affect HbA1c levels in addition to glycemic status. RBC turnover increases in thyrotoxic states, but decreases in hypothyroidism. Hypothyroidism is one of the causes of hypoproliferative anaemia, which can lead to an erroneous increase in HbA1c and a misdiagnosis of diabetes or pre-diabetes.

Hence the present study was conducted to study the effects of thyroxine replacement on glycosylated haemoglobin levels in hypothyroidism among hypothyroid patients attending OPD of a tertiary care hospital, Guntur.

Material and Methods

Study design and participants

The prospective study includes 100 subjects diagnosed with hypothyroidism at Department of General Medicine, NRI Medical College and General Hospital, Mangalagiri, Guntur, Andhra Pradesh. Study subjects were included after detailed explanation about the study and obtaining written informed consent and Ethical Committee approval was also obtained before starting of the study.

The following are the inclusion and Exclusion criteria of the study

Inclusion criteria

- All hypothyroid patients

Exclusion criteria

- All diabetes patients
- Anaemic patients
- Known hemoglobinopathies
- Renal or Liver diseases
- Recent blood transfusions (< 3 months)
- Pregnancy

Specimen

Blood sample (random) was taken from each individual, serum sample was obtained by centrifugation of blood samples at 2000 RPM for 10min, and it was stored at -20° until the date of analysis. The parameters like Complete blood count, reticulocyte count, fasting blood glucose, post prandial blood glucose, HBA1C, TSH, and T4 were determined by spectrophotometric and by using Biochemistry Fully Automated Analyser.

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Statistic analysis

Qualitative data was expressed in frequencies and percentages and Quantitative data in mean and standard deviation. Non parametric statistics i.e. Chi square test was used to find the significant association between the two qualitative variables. Independent t test was used to find the statistical significance between quantitative variables. Bar diagrams and pie chart were used to represent the data. P value of <0.05 was considered statistically significant.

Results and Observations

Age

The mean age of the participants observed in the present study was found to be 43.23 ± 8.50 years. Majority (48%) of the study participants belonged to the age group of 46-55 years, 35% were in the age group of 36-45 years, 13% were in the age group of 26-35 years, 4% belonged to the age group of 19-25 years.

Distribution of individuals on gender basis

In the present study 41% were male and 59% were female.

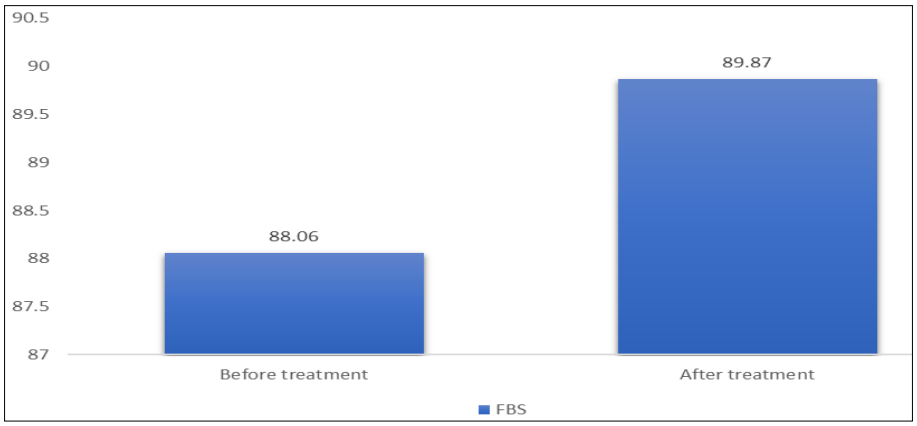

Fig 1: Correlation between Pre and Post treatment of FBS levels

Range of FBS before treatment 80-99, whereas after treatment the values ranged between 80-98 mg/dl. The mean FBS value before treatment was 88.06 ± 5.35 and after treatment it was 89.87 ± 5.47. The FBS values raised significantly (p<0.02) in the post treatment period (Figure 1).

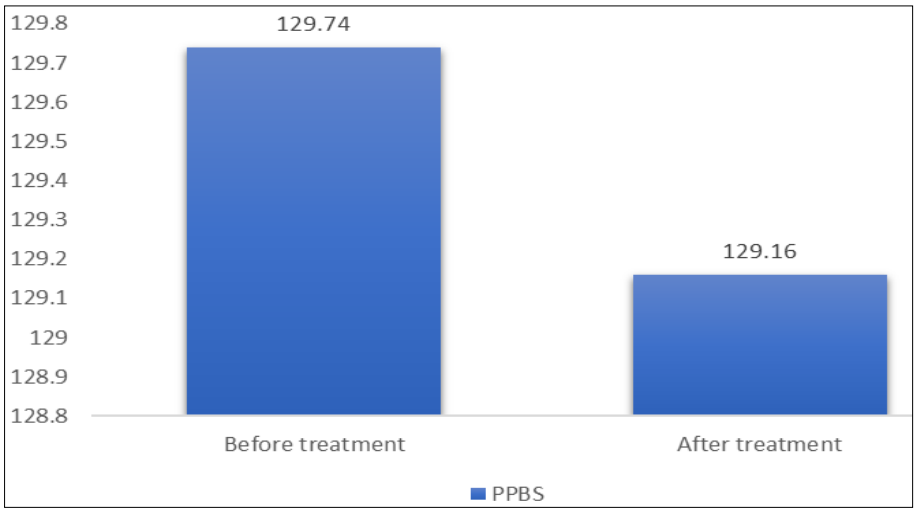

Fig 2: Correlation between Pre and Post treatment of PPBS levels

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In the pre-treatment period the PPBS values ranged from 120-139 and even in the post treatment phase it remained the same. There were no significant (p<0.39) changes in the PPBS levels in pre and post treatment period (Figure 2).

Table 1: HbA1c distribution before and after treatment

	HbA1c		Mean ±SD	SE	95% CI		P value
	Minimum	Maximum			Lower	Upper	
Before treatment	5.1	6.7	5.86 ± 0.39	0.03	5.78	5.93	<0.0001*
After treatment	5	5.6	5.25 ± 0.21	0.02	5.21	5.29	

In the pre-treatment period the Hb A1C ranged from 5.1-6.7 and in the post treatment phase it ranged from 5-5.6, the mean value of HbA1C before treatment was 5.86 ± 0.39 and the mean value of HbA1C after treatment was 5.25 ± 0.21 the mean values of HbA1C decreased significantly (p<0.0001) after treatment when compared to the pre-treatment levels (Table 1).

Discussion

Thyroid hormone increases erythrocyte synthesis, and hypothyroidism frequently results in hypoproliferative erythropoiesis. Furthermore, thyroid hormone increases albumin metabolism, and albumin breakdown is inhibited in hypothyroidism. As a result, we postulated that A1C or GA readings do not adequately reflect glycemia in hypothyroidism. Thus, we wanted to see how thyroid hormone affected A1C and GA levels in nondiabetic patients with overt hypothyroidism In this respect, the current study was carried out to study the effects of thyroxine replacement on glycosylated haemoglobin levels in hypothyroidism [13].

The mean age of the participants observed in the present study was found to be 43.23 ± 8.50 years. Majority of the study participants belonged to the age group of 46-55 years. In the study conducted by Ram and co-workers [14] the mean age of the participants was 46.90±12.84 and the mean age observed was in consonance with the present study.

In the present study 41% were male and 59% were female. In the study conducted by Makadiaand co-workers [15] also observed female preponderance was observed and this finding made was in consonance with the present study findings. As well the similar finding was seen in the study conducted by Ram group [14] they have also observed the similar findings.

The mean FBS value before treatment was 88.06 ± 5.35 and after treatment it was 89.87 ± 5.47. The FBS values raised significantly in the post treatment period. In the study conducted by Makadia and co-workers [15] also observed FBS preponderance and this finding made was in consonance with the present study findings. As well the similar finding 92.98 ± 4.95 was seen in the study conducted by Ram group [14] they have also observed the similar findings.

In the pre-treatment period the PPBS values ranged from 120-139 and even in the post treatment phase it remained the same. There were no significant changes in the PPBS levels in pre and post treatment period. In the pre-treatment period the Hb A1C ranged from 5.1-6.7 and in the post treatment phase it ranged from 5-5.6, the mean value of HbA1C before treatment was 5.86 ± 0.39 and the mean value of HbA1C after treatment was 5.25 ± 0.21 the mean values of HbA1C reduced considerably with treatment when compared to the pre-treatment levels similar observation 5.57 ± 0.26 were also seen with earlier studies [6].

In the study conducted by Ram and group[14] the mean HbA1c levels were 5.65±0.34% and 5.13±0.31% in the case and the control groups respectively. There was statistically significant difference with the p-value of <0.0001. The levels of HbA1c (%) were substantially higher in the case group compared with the control group

To conclude, the findings of the study, HbA1c levels in patients with hypothyroidism are falsely elevated out of proportion to their level of glycemia, resulting in a false diagnosis of

dysglycemia. However, after thyroxine replacement and the achievement of a euthyroidal state, HbA1c levels are lowered without any change in blood sugar levels.

The diagnosis of pre diabetes or diabetes in hypothyroid patients should therefore be made solely on the basis of fasting blood glucose and postprandial blood glucose in these patients. As a result, we conclude that the HbA1c test is not a reliable method for diagnosing pre-diabetes or diabetes in the presence of hypothyroidism or thyroid dysfunction.

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