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To Study The Levels Of Glucose Profile In Hypothyroid Patients Suffering With Type 2 Diabetes Mellitus

Manikant choudhary[1], Dr. Shreya Nigoskar[2]
Manikant choudhary, Ph. D scholar, Department of Biochemistry, Malwanchal university, Indore, MP
Dr. Shreya Nigoskar, Professor, Dept. Of biochemistry, Index medical college, Indore, MP

Abstract:
Background: *The increased risk of cardiovascular disease is attributed to the cluster of metabolic abnormalities known as hypothyroid patients affected with type 2 diabetes mellitus (T2DM). Most people with hypothyroid patients affected with T2DM also have several other metabolic problems, including high blood sugar, insulin resistance, and high blood pressure.*
Aim: *To assess the effect of free T3 (FT3), free T4 (FT4), thyroid stimulating hormone (TSH), glucose profile, insulin, and Homoeostasis model assessment- estimated insulin resistance (HOMA-IR) in hypothyroid patients affected with T2DM.*
Materials & methods: *All the study participants consented. Control volunteers were 100 age- and gender-matched healthy volunteers. Second cohort: 100 hypothyroid patients affected with T2DM patients treated, and third cohort only hypothyroid patients of 100 in number. Same-age as well as gender normal-glycemic controls were used as the non-hypothyroid patients not affected with T2DM group. Each cohort was designated as normal if Body Mass Index (BMI) was (18.5-24.9 kg per m2), overweight (25-29.9 kg per m2), or obese (30 kg per m2).*
Results: *There was a statistically significant variation between 2 groups in terms of hemoglobin A1c (HbA1c), fasting blood sugar (FBS), and insulin mean values. Figure 1 displays the average levels of FBS in patients having hypothyroid patients affected with T2DM and in healthy control subjects. Serum weight measurements were found to be significantly varied between 2 groups. Hypothyroid patients affected with T2DM sufferers had a mean FBS levels that was somewhat elevated compared to the control group, although they were still only around 40% higher than the norm.*
Conclusion: *To assist clinicians better manage hyperglycemia and prevent the onset of associated disorders, more research along these lines is urged.*
Keywords: *Hypothyroid patients affected with T2DM; Homeostasis Model Assessment of Insulin Resistance (HOMA-IR); Hyperglycemia; Insulin; Insulin resistance.*

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I. Introduction:

According to the American Heart Association, it is estimated that around three million children and adolescents in the United States, aged 12 to 19, are affected by both hypothyroid patients affected with Type 2 Diabetes Mellitus (T2DM) [1]. The prevalence of overweight or obesity among adolescents increases to 44%. Based on the findings of the study, it was observed that a proportion of 19.52 percent of the individuals examined in India exhibited comorbidity between hypothyroid patients affected with T2DM. The recent study [2] found that there was a higher prevalence of hypothyroid individuals with T2DM among Indian women (35%) compared to men (26%).

The cluster of metabolic abnormalities observed in hypothyroid patients affected with T2DM is considered responsible for the heightened susceptibility to cardiovascular disease and T2DM. The majority of individuals diagnosed with hypothyroidism who also have T2DM commonly experience a range of other metabolic complications, such as elevated blood glucose levels, insulin resistance, atypical lipid profiles, and hypertension [3-10]. A strong correlation exists between glucose and insulin in the metabolic processes of the human body. Insulin, a hormone, regulates glucose metabolism by facilitating cellular glucose uptake. Glucose serves as the primary energy source for the body [11,12]. Insulin resistance, a condition characterized by reduced sensitivity to insulin signaling and subsequent elevation of glucose levels, is frequently observed in individuals with hypothyroidism who also have T2DM [13,14]. The Homeostatic Model Assessment of Insulin Resistance (HOMA-IR) is a widely utilized instrument that employs measurements of fasting insulin and glucose levels to get an approximation of insulin resistance. Individuals who exhibit insulin resistance and possess a high value of HOMA-IR are at an elevated risk of acquiring T2DM and cardiovascular disease [15-22]. Insulin resistance and glucose intolerance, which are commonly observed in individuals with hypothyroid patients affected with T2DM,

frequently coexist with dyslipidemia. In summary, individuals with metabolic diseases have significant correlations among glucose, insulin, HOMA-IR, and lipids [16-19]. Hyperglycemia, dyslipidemia, and an increased susceptibility to cardiovascular disease and type II diabetes are prominent features observed in hypothyroid patients with comorbid T2DM, which is distinguished by the presence of insulin resistance [18-22]. This study aimed to assess the effect of free T3 (FT3), free T4 (FT4), thyroid stimulating hormone (TSH), glucose profile, insulin, HOMA-IR, in hypothyroidism only and also comorbid T2DM.

II. Materials & methods:

The present study involved a total of 300 participants, with 100 individuals assigned to the group of hypothyroid patients affected by T2DM, 100 patients of only hypothyroid patients and another 100 individuals assigned to the healthy control group. The primary emphasis of this study was on the patients receiving medical care at the Index Medical College & Research Centre located in Indore. Upon obtaining authorization from the relevant authorities, the researchers of the study initiated their endeavours. Prior to the commencement of this investigation, every participant provided informed consent. Patients with type 1 diabetes or a history of pathological symptoms, as well as those with T2DM duration of less than five years, were excluded from the study. The healthy control group exhibited the absence of diabetes, the non-usage of multivitamins, and the absence of comorbid illnesses.

All individuals in both groups were assessed by a certified medical professional from the hospital's medical department, who followed established protocols and took into account the criteria for inclusion and exclusion in the study. The control group consisted of 100 volunteers who were matched in terms of gender and age and did not have hypothyroidism or T2DM. The second cohort consisted of 100 patients who were on therapy for hypothyroidism and also had comorbid T2DM. The identification of hypothyroid patients affected by T2DM was conducted using the criteria set by the Adult Treatment Panel III (ATP-III). The control group consisted of human volunteers who were of similar age and gender and had a normal glycemic status. Every participant underwent a comprehensive medical evaluation conducted by a certified physician who strictly adhered to standardized medical protocols. The identification of hypothyroid patients with comorbid T2DM) was conducted using the criteria set by the Adult Treatment Panel III (ATP-III). The calculation of BMI involved dividing the weight (measured in kilogrammes) of each participant by the square of their height (measured in meters). Following the calculation of each individual's body mass index (BMI), the participants were subsequently categorized into distinct categories. The World Health Organization's analytical criteria for obesity in BMI among Asian populations were utilized to classify individuals into three distinct categories within each cohort: overweight (25-29.9 kg per m2), normal weight (18.5-24.9 kg per m2), and obese (30 kg per m2). In a controlled and sanitary setting, a disposable syringe and cannula were employed to extract 5ml of fasting venous blood from each participant. The blood samples were then collected into flat containers for both experimental groups. Following a centrifugation process at a speed of 3000 revolutions per minute for a duration of 20 minutes, the blood samples were effectively separated, resulting in the isolation of serum. Subsequently, the obtained serum samples were divided into smaller, equal portions, known as aliquots, and were then appropriately preserved at a temperature of 20°C.

The plasma glucose levels were measured using Avantor Laboratories' DPEC-GOD/POD method. The reagents were produced as a result of following the directions provided in the manual. The ClinRep complete kit was employed for the quantification of HbA1C on the BioRad Diamant and Variant instruments. The typical range for the given parameter is between 4.5% and 6.1%. The measurement of serum insulin levels was conducted using an LDN IRMA reagent. The directions provided by the supplier were adhered to. The test demonstrated a sensitivity of 0.5 IU/mL, with coefficients of variation (CVs) of 4.5 % and 5.6% for intra- and inter-assay measurements, respectively. The calculation of HOMA-IR was performed as described by Muniyappa et al. (2008). The reagents used in this study were obtained from Avantor Performance Materials India Limited, located in Dehradun, Uttarakhand, India. The estimation procedure was conducted in accordance with the instructions provided in the kit manual. The directions provided by the supplier were adhered to.

Statistical analysis:

An unpaired "t" test was conducted to compare the means of the variables between two groups. In addition, percentages were calculated. Scatter plots were employed to examine the association between the two variables. In addition, percentages were calculated. A significant level of 0.05 was deemed acceptable.

III. Results:

Table 3 displays the observed levels of FBS, PPBS, HbA1c, insulin, and HOMA-IR in both research groups. The results of the statistical analysis indicate that there were significant differences in FBS ($t=13.15$; $df=198$; $P<0.001$), HbA1c ($t=17.51$; $df=198$; $P<0.05$), and insulin mean levels ($t=3.81$; $df=198$; $P<0.05$) between the two groups of study, as shown in Table 3. The average post-prandial blood glucose level in individuals with

hypothyroid with T2DM is 197±73.4, while the average plasma glucose level in healthy control patients is 134.8±22.6 (refer to Figure 4). In the instance of HOMA-IR, a nearly fifty percent elevation in levels was reported among individuals with hypothyroid with T2DM compared to control patients. The study quantified the percentage increase resulting from the inclusion of age and sex-matched participants in both experimental groups. Furthermore, in order to determine the intensity of infrared (IR) in both groups of subjects, we computed the HOMA-IR. A significant difference was not found in FBS, PPBS, HbA1C, Insulin concentrations when compared between the groups except for HOMA-IR. But when comparing the three groups in the study, there was statistical significance in the case with FBS, HbA1C, Insulin, and HOMA-IR.

Table 1: The study examines the glycemic profile of individuals with hypothyroidism who are also affected by type 2 diabetes mellitus (T2DM), only hypothyroidism affected patients and as well as a control group of people.

Variable	Hypothyroid with T2DM Subjects (n=100)	Hypothyroid patients (n=100)	Healthy Controls (n=100)	P Value (ANOVA)
FBS (mg/dL)	143.9±56	124.6 ± 78	97.7 ± 22	**<0.0001**
PPBS (mg/dL)	148 ±73.4	143.6 ± 73.4	134.8 ± 22.6	> 0.05
HbA1C (gm%)	8.0 ± 2.6	7.6 ± 5.8	6.4 ± 1.9	**<0.05**
Insulin (µU/mL)	31.2 ± 5.0	29.2 ± 4.3	28.5 ± 0.6	**<0.05**
HOMA-IR	34.9 ± 2.3	22.3 ± 12.4	6.8 ± 3.9	**<0.0001**

Table 2: Thyroid profile in hypothyroid with T2DM subjects and control subjects

Variable	Hypothyroid with T2DM group (n=100)	Hypothyroid patients (n=100)	Control group (n=100)	P- value (ANOVA)
FT3 (nmol/L)	1.1 ± 0.5	1.3 ± 1.1	1.5 ± 0.89	NS
FT4 (nmol/L)	54.2 ± 33.8	72.3 ± 44.8	123 ± 24.6	S
TSH (mU/L)	18.7 ± 5.2	10.6 ± 6.3	2.9 ± 0.9	S

Significant (S) when the p-value is less than 0.05 and not significant (NS) when the p-value is more than 0.05. Triiodothyronine (T3), tetra-iodothyronine (T4), thyroid stimulating hormone (TSH), T2DM, and significant (S) when the p-value is less than 0.05.

The quantities of the hormones FT3, FT4, and TSH are presented in the table that may be found above. It was discovered that the level of FT3 in hypothyroid individuals with T2DM was not significantly different from the amount detected in healthy controls ($t = 2.978$, $d = 198$, $P = 0.021$). When compared to a control group consisting of healthy persons, the levels of FT4 ($t = 6.986$, $d = 198$, $P = 0.0001$) and TSH ($t = 28.534$, $d = 198$, P 0.0001) displayed a significant degree of statistical significance in hypothyroid patients with T2DM. This was the case when the results were examined.

IV. Discussion:

Patients with hypothyroid patients affected with T2DM may set off a chain reaction that worsens their condition. Hypothyroidism is associated with hyperglycemia and a high body mass index in patients with T2DM, suggesting that this disease may function as a trigger in the chain reaction. This is because T2DM hypothyroid people tend to be on the obese side. This condition is caused in part by hyperglycemia and in part by a increase of body fat.

Hypothyroid patients with T2DM had higher FBS, HbA1c, and insulin levels compared to only hypothyroid patient group and to healthy control group. It was found that there were no statistically significant variations in age between the groups. This conclusion is based on the data from the study. Patients diagnosed with hypothyroidism who were also affected by T2DM showed an increase in fat-free mass in this study. This trend in body composition was not seen in those who were physically strong enough to serve as controls [21-26]. This

study suggests that ageing may be responsible for the increased prevalence of T2DM among hypothyroid patients. Our results also highlight the importance of considering the effects of ageing on hypothyroid, T2DM patients. Previous studies have shown that T2DM is one of the disorders typically related with ageing in hypothyroid people [12,13]. Hypothyroidism in T2DM is more common in those over the age of 40, according to research [1,8,12,14, 17,22]. Two independent analyses led to this verdict. There was no age difference in blood sugar levels between the control group and the experimental group. However, we did find an age disparity between T2DM patients with and without hypothyroidism, however it was not statistically significant. This data implies that the risk of developing T2DM is higher in patients with a high hypothyroid tendency compared to those with a low predisposition. That is to say, those who already have a genetic propensity towards metabolic diseases are more likely to develop the condition than those who do not. Hypothyroid patients affected with T2DM are more common in people who have a family history of the disease. persons over the age of 65 have the highest prevalence of diabetes; however, older persons are often left out of numerous studies, including diabetes research [16,17].

Important research into the correlation between age and HbA1c in hypothyroid patients with T2DM and healthy controls is warranted. This was separately uncovered by both volunteer organizations. While this may seem counterintuitive at first, it has been suggested that the increase in HbA1c is a compensatory reaction to both the ageing process and the creation of free radicals. Another explanation that makes sense is that the increase in HbA1c results from a combination of the natural ageing process and the creation of free radicals. The accumulation of HbA1c has been linked to both ageing and the creation of free radicals, according to the oxidative stress theory. That's a perfectly reasonable answer, by the way. Individuals with metabolic problems are more likely to have increased oxidative stress compared to healthy controls or individuals of the same age, as shown by a number of studies [14-21]. Research shows that oxidative stress is increased in both hypothyroid patients affected with T2DM and older controls [17-20], despite the fact that no attempt was made to detect levels of free radicals.

Postprandial blood glucose levels and serum weight were significantly different in hypothyroid T2DM patients compared to healthy controls. This became clear when hypothyroid patients with T2DM were compared to control subjects. Weight, a hormone that regulates endocrine and metabolic processes, is produced by the pineal gland and other organs. Keeping the sweet spot between normal normoglycemia and high hyperglycemia requires the interplay between body mass index and insulin. This state is essential for the organism to carry out its regular functions. Hyperglycemia arises in people when there is a breakdown in crosstalk, as shown in research [15, 16] conducted all over the world. Genome-wide studies [12,13] show a connection between obesity, hyperglycemia, and the development of hypothyroidism and T2DM in predisposed individuals. Obesity has been shown to improve insulin sensitivity in the past [17,18]. These results are supported by the observation that insulin imbalance may enhance insulin resistance and hyperglycemia [17-22]. People with greater blood glucose levels were also shown to be less likely to be obese. This is so because glucose inhibits fat storage. This study provides further evidence that hypothyroid people with T2DM also experience hyperglycemia. Hypothyroidism caused by T2DM, leading to postprandial hyperglycemia, was more common in underweight people.

V. Conclusion:

To assist clinicians better manage hyperglycemia and prevent the onset of associated disorders, more research along these lines is urged. Researchers will get new molecular insights from these studies, which could one day aid in the treatment of hyperglycemia. According to these findings, hypothyroid patients with T2DM may not have developed appropriate compensation mechanisms to deal with pathophysiological anomalies. The current study was able to confirm this finding despite the dearth of past substantial research into the subject at hand.

References:

[1]. Duntas LH, Orgiazzi J, Brabant G. The Interface Between Thyroid And Diabetes Mellitus. Clinical Endocrinology. 2011 Jul;75(1):1-9.
[2]. Kar K, Sinha S. Variations Of Adipokines And Insulin Resistance In Primary Hypothyroidism. Journal Of Clinical And Diagnostic Research: JCDR. 2017 Aug;11(8):BC07.
[3]. Biondi B, Kahaly GJ, Robertson RP. Thyroid Dysfunction And Diabetes Mellitus: Two Closely Associated Disorders. Endocrine Reviews. 2019 Jun;40(3):789-824.
[4]. Wang C. The Relationship Between Type 2 Diabetes Mellitus And Related Thyroid Diseases. Journal Of Diabetes Research. 2013 Oct;2013.
[5]. Abdullah JN, Mohammed SB, Al-Auqbi TF. Evaluation Of The Osteoprotegerin And Insulin Levels In Patient's Serum With Hypothyroid And Hypothyroid With Type 2 Diabetes Mellitus. Eurasian Chemical Communications.. 2021;3(11):9-854.
[6]. Phenekos C, Vryonidou A, Gritzapis AD, Baxevanis CN, Goula M, Papamichail M. Th1 And Th2 Serum Cytokine Profiles Characterize Patients With Hashimoto's Thyroiditis (Th1) And Graves' Disease (Th2). Neuroimmunomodulation. 2004 Jul 9;11(4):209-13.
[7]. Bashir H, Bhat SA, Majid S, Hamid R, Koul RK, Rehman MU, Din I, Bhat JA, Qadir J, Masood A. Role Of Inflammatory Mediators (TNF-A, IL-6, CRP), Biochemical And Hematological Parameters In Type 2 Diabetes Mellitus Patients Of Kashmir, India. Medical Journal Of The Islamic Republic Of Iran. 2019;34:5.
[8]. Kishazi E, Dor M, Eperon S, Oberic A, Turck N, Hamedani M. Differential Profiling Of Lacrimal Cytokines In Patients Suffering From Thyroid-Associated Orbitopathy. Scientific Reports. 2018 Jul 17;8(1):10792.

[9]. Ragusa F, Fallahi P, Elia G, Gonnella D, Paparo SR, Giusti C, Churilov LP, Ferrari SM, Antonelli A. Hashimotos' Thyroiditis: Epidemiology, Pathogenesis, Clinic And Therapy. Best Practice & Research Clinical Endocrinology & Metabolism. 2019 Dec 1;33(6):101367.
[10]. Eaton SE, Euinton HA, Newman CM, Weetman AP, Bennet WM. Clinical Experience Of Amiodarone-Induced Thyrotoxicosis Over A 3-Year Period: Role Of Colour-Flow Doppler Sonography. Clinical Endocrinology. 2002 Jan;56(1):33-8.
[11]. Romagnani S. Lymphokine Production By Human T Cells In Disease States. Annual Review Of Immunology. 1994 Apr;12(1):227-57.
[12]. Babaev EA, Balmasova IP, Mkrtumyan AM, Kostryukova SN, Vakhitova ES, Il'ina EN, Tsarev VN, Gabibov AG, Arutyunov SD. Metagenomic Analysis Of Gingival Sulcus Microbiota And Pathogenesis Of Periodontitis Associated With Type 2 Diabetes Mellitus. Bulletin Of Experimental Biology And Medicine. 2017 Oct;163:718-21.
[13]. Kontoangelos K, Papageorgiou CC, Raptis AE, Tsiotra P, Boutati E, Lambadiari V, Papadimitriou GN, Rabavilas AD, Dimitriadis G, Raptis SA. Cytokines, Diabetes Mellitus And Psychopathology: A Challenging Combination. Neuroendocrinology Letters. 2014 Jan 1;35(2).
[14]. Carella C, Mazziotti G, Amato G, Braverman LE, Roti E. Interferon-A-Related Thyroid Disease: Pathophysiological, Epidemiological, And Clinical Aspects. The Journal Of Clinical Endocrinology & Metabolism. 2004 Aug 1;89(8):3656-61.
[15]. Mikos H, Mikos M, Rabska-Pietrzak B, Niedziela M. The Clinical Role Of Serum Concentrations Of Selected Cytokines: IL-1 B, TNF-A And IL-6 In Diagnosis Of Autoimmune Thyroid Disease (AITD) In Children. Autoimmunity. 2014 Nov 1;47(7):466-72.
[16]. El-Sheikh HM, El-Haggar SM, Elbedewy TA. Comparative Study To Evaluate The Effect Of L-Carnitine Plus Glimepiride Versus Glimepiride Alone On Insulin Resistance In Type 2 Diabetic Patients. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2019 Jan 1;13(1):167-73.
[17]. Eom YS, Wilson JR, Bernet VJ. Links Between Thyroid Disorders And Glucose Homeostasis. Diabetes & Metabolism Journal. 2018 Mar 24;46(2):239-56.
[18]. Nishi M. Diabetes Mellitus And Thyroid Diseases. Diabetology International. 2018 May;9(2):108-12.
[19]. Brenta G. Diabetes And Thyroid Disorders. The British Journal Of Diabetes & Vascular Disease. 2010 Jul;10(4):172-7.
[20]. Wu P. Thyroid Disease And Diabetes. Clinical Diabetes. 2000 Jan 1;18(1):38-.
[21]. Hage M, Zantout MS, Azar ST. Thyroid Disorders And Diabetes Mellitus. Journal Of Thyroid Research. 2011 Oct;2011.
[22]. Brenta G, Caballero AS, Te Nunes M. Case Finding For Hypothyroidism Should Include Type 2 Diabetes And Metabolic Syndrome Patients: A Latin American Thyroid Society (LATS) Position Statement. Endocrine Practice. 2019 Jan 1;25(1):101-5.