ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 6, Issue – 1, February - 2023, Page No. : 606 - 611

To assess insulin status and correlation with thyroid profile and oxidative stress in type 2 diabetic subjects

[1]Dr. Brijendra Singh Hindoliya, PhD Research Scholar, Department of Biochemistry, Index Medical College Hospital and Research Centre, Indore, MP.

[2]Dr. Jaya Jain, Professor, Department of Biochemistry, Index Medical College Hospital and Research Centre, Indore, MP.

[3]Dr.Ashutosh Jain, Assistant Professor, Dept. of Physiology, IMCHRC Indore, MP.

[4]Dr.Bedabrata Mukhopadhyay, Assistant Professor, Dept. of Biochemistry, Santiniketan Medical College Bolpur, Santiniketan

Corresponding Authors: Dr. Bedabrata Mukhopadhyay, Assistant Professor, Dept. of Biochemistry, Santiniketan Medical College Bolpur, Santiniketan

How to citation this article: Dr. Brijendra Singh Hindoliya, Dr. Jaya Jain, Dr. Ashutosh Jain, Dr. Bedabrata Mukhopadhyay, "To assess insulin status and correlation with thyroid profile and oxidative stress in type 2 diabetic subjects", IJMACR- February - 2023, Volume – 6, Issue - 1, P. No. 606 – 611.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: The principal changes that occur in the hormone system are those associated with the hormones free triiodothyronine (FT3) and free tetra iodothyronine (FT4) thyroid stimulating hormone (TSH), and insulin.

Aim: The present study aim was to assess insulin status and its correlation with thyroid profile and oxidative stress in type 2 diabetic (T2DM) subjects.

Materials & methods: This case-control research includes 100 T2DM and 100 healthy control participants. Index Medical College & Research Center, Indore, outpatient departments examined all participants in both groups. The study authors began after receiving institutional ethics committee approval. Participants gave informed consent before the trial began.

Results: The MDA level was significantly higher and lower GSH level in T2DM patients compared with healthy controls.

TSH and insulin levels were extremely significantly in T2DM patients compared with healthy controls.In the present study, we observed a negative decline association between serum insulin and thyroid stimulating hormone levels in T2DM subjects.

Conclusion: Increased insulin and TSH levels may prevent serum and tissue pathology. Increasing insulin and TSH separately or together may do this. Insulin and TSH promote insulin sensitivity, and antioxidant action. Increasing insulin or TSH levels alone or together may cause this and regardless of whatever level improves first, it is possible.

Keywords: Free Triiodothyronine, Free Tetra Iodothyronine, Thyroid Stimulating Hormone, Insulin And Insulin Sensitivity.

Introduction

In the year 2000, diabetes was declared to be present in 171 million persons worldwide [1-3]. To put it another way, diabetes is a pretty prevalent disease. By 2030, it is predicted that there will be 366 million people on the planet [2]. Although the prevalence of type 2 diabetes varies from region to region in India, the ailment is thought to afflict between 5 and 14% of the population [3]. In India, it was estimated that 31 million individuals had diabetes in 2000, and by 2030, it is expected that this number will rise to 79 million over the entire nation [1]. India is anticipated to maintain its status as the world's diabetes capital for the ensuing thirty years [4] as a direct result of this.

Diabetes increases a person's risk for a range of microvascular and macrovascular issues, including diabetic retinopathy, a well-known microvascular issue [5]. Diabetes increases the risk of several other conditions, such as heart disease and stroke, in diabetics. People with diabetes are more likely to develop a number of additional illnesses, some of which can affect the cardiovascular system [6]. In addition to ongoing patient monitoring through the utilization of measures such as glycated hemoglobin, it is vital that improved diagnostic parameters be created [7]. The principal changes that occur in the hormone system are those associated with the hormones free triiodothyronine (FT3) and free tetra iodothyronine (FT4) thyroid stimulating hormone (TSH), and insulin. These hormones are made by the thyroid, which is located in the neck, and they are necessary for the vast majority of the metabolic processes that take place in our bodies. These modifications could be the result of central hypothyroidism [23-24]. They are necessary for the preservation of homeostasis in situations where there is a disturbance in the usual balance of hormones in the blood. It has been linked to an increased risk of developing a number of health conditions, including diabetes, cardiovascular disease, and chronic liver disease [25]. The present study aim was to assess insulin status and its correlation with thyroid profile and oxidative stress in type 2 diabetic (T2DM) subjects.

Materials & methods

The present study is a case-control study comprised of hundred (100) subjects each in T2DM group and healthy control group. All the subjects of both groups were scrutinized from the out-patient departments of Index Medical college & research center, Indore. After taking permission from the institutional ethics committee, the authors of the study have initiated the work. Before commencing the present study and from each participant informed consent has been obtained.

Exclusion criteria

Type 1 diabetes individuals, and T2DM individuals with pathological conditions. Each diabetic and non-diabetic has no history of thyroid disorder, study exclude very ill patient with complication of diabetes, cardiovascular events or myocardial infarction, cancer and patients with endocrinological dysfunction, morbid obese.

Inclusion criteria

for healthy controls were non-diabetic, not taking multivitamin supplementations, and having no other secondary pathologies. Coming to T2DM group subject not taking any antihyperglycemic drug, diuretics, fasting blood glucose level ≥ 126 mg/dl, glycated hemoglobin ≥ 6.5%, Oral glucose tolerance test ≥ 200 mg/dl.Fasting venous blood (5ml) were drawn into EDTA and plane

vials, after informed written consent from all the study group subjects. Serum was separated by centrifuging the blood at 3000 rpm for 20 minutes and stored in aliquots at -20^{o} C until assayed. The Human insulin, FT3, FT4, TSH were estimated by solid-phase sandwich ELISA (enzyme-linked immunosorbent assay) is designed to measure the amount of the target bound between a matched antibody pair. Estimation of Lipid peroxidation was done by employing the method Thiobarbituric acid reducing substances (TBARS) of Kei Satoh et al. Estimation of serum GSH was done by the method of Ellman 1959.

Statistical analysis

Excel 2010 spreadsheets will analyze data. SD shows variable results. All p 0.05 statistically significant tests will be analyzed using Microsoft Excel and IBM SPSS for Windows. Student independent sample t tests compare cases and controls statistically. Pearson's correlation coefficient calculated parameter correlation. $p < 0.05$ indicated statistical significance.

Results

Variable	T2DM group (n=100)	Control group (n=100)	P-value
FT3 (nmol/L)	1.1 ± 0.4	1.4 ± 0.8	NS
FT4 (nmol/L)	88.1 ± 38.5	112.2 ± 21.3	S
TSH (mU/L)	14.4 ± 4.9	3.9 ± 0.8	S
Insulin (pg./mL)	13.7±1.9	34.9±10.4	S

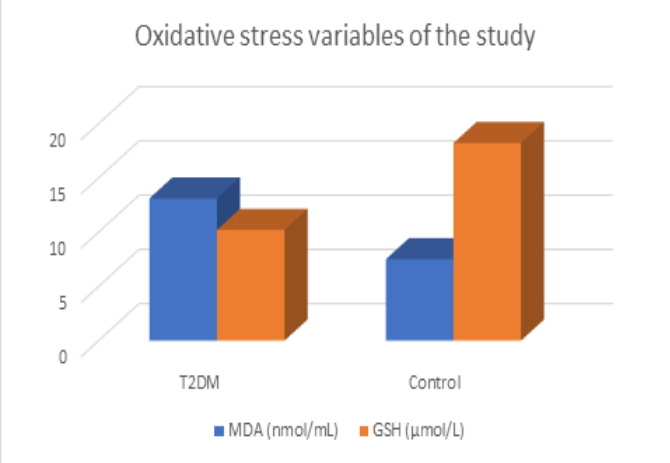
Table 1: Thyroid profile in T2DM subjects and control subjects

FT3 (Triiodothyronine); FT4 (Tetra-iodothyronine); TSH (Thyroid Stimulating Hormone); T2DM (T2DM Mellitus); S (Significant < 0.05); NS (Not Significant > 0.05).

FT3, FT4, and TSH hormone levels are shown in table above. The T3 (t=1.1180, d=198, P = 0.269) level was not significantly in T2DM patients compared with healthy controls. The T4 (t=5.4774, d=198, P = 0.0001) and TSH (t = 23.4787, d=198, P < 0.0001)

levels were extremely significantly in T2DM patients compared with healthy controls. Insulin (t=7.352, d=198), shown to be significantly higher in T2DM patients compared with healthy controls.

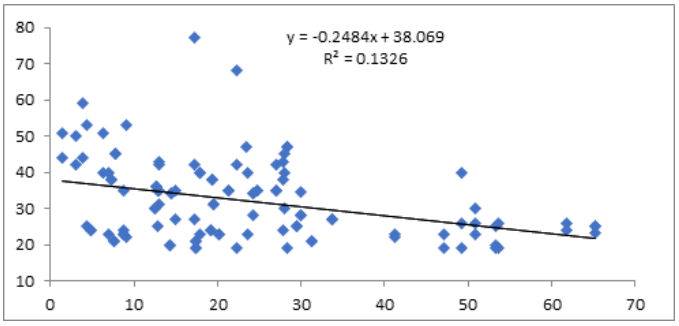
Figure 1: Bar diagram showing the oxidative stress parameters of the present study subjects of both groups.



MDA (nmol/mL) and GSH (µmol/L) levels are shown in table above. The MDA (t=9.2063, d=198, p = < 0.005) level was significantly higher in T2DM patients compared with healthy controls. Similarly.

we observed statistically significant in case of GSH (t=6.8135, d=198, p = < 0.005) level when compared between T2DM patients and healthy controls.

Figure 2: Regression graph showing inverse relationship between serum insulin and thyroid stimulating hormone in T2DM subjects.



In the present study, we observed a negative decline association between serum insulin and thyroid stimulating hormone levels in T2DM subjects (Figure 2). Scatter diagram showing negative relationship (y = -0.2484x + 38.06).

Discussion

The present study detected decreased GSH levels in T2DM patients than healthy patients [1]. These reduced levels contribute to oxidative stress, which may explain the risk link between oxidative stress and T2DM. T2DM patients' GSH levels dropped significantly, which was intriguing. These findings have no reasonable interpretations. These intriguing observations require further study to explain. However, since a drop in antioxidant levels like GSH would not eliminate ROS, particularly hydrogen peroxide, which harmed cellular membranes and increased MDA [2], this could explain the lower levels [3-7]. This could explain the findings. The observations may be due to an Both scenarios will be detailed below [4].

Dyslipidemia may have increased lipid peroxides, further insulting the antioxidant status in our investigation. T2DM individuals with elevated MDA had dyslipidemia [8]. Multiple tests confirm that diabetes mellitus reduces antioxidant levels [9]. Glycation of antioxidant enzymes in prolonged hyperglycemia can degrade the antioxidant defense system and induce oxidative damage. Hyperglycemia lowered antioxidant levels in animal studies, including humans [10]. Humans also showed similar association (SOD, CAT, and GSH). GSH was lower than expected in T2DM patients with coronary artery calcification [2-10].

Human GSH levels were lower than expected, perhaps because to ROS removal [11]. MDA alone does not cause oxidative stress in T2DM [40]. Oxidative stress problems are more likely in T2DM [12]. Healthy controls have lower HbA1c than unhealthy ones. In healthy people, GSH levels correlated positively. T2DM patients showed higher HbA1c and reduced GSH. Hyperglycemia and reactive oxygen species can lower GSH levels in T2DM patients. Age may aggravate T2DM [13]. Oxidative stress causes insulin resistance and glucose absorption. Lower GSH levels cause insulin resistance [14,15]. Diabetes patients have abnormally low GSH levels [12,13]. Free radical reduction requires GSH [16]. Any change in redox pair molecules may decrease GSH since it maintains the cell's redox potential [17]. The aldose reductase enzyme in the sorbitol pathway increases the NADPH/NADP ratio in diabetics. Diabetes increases the enzyme's aldose-to-sorbitol conversion rate [18]. Our findings suggest that decreased glutathione S-transferase (GSH) levels are linked to greater blood sugar and reactive oxygen species (ROS). The sick group's considerably lower glutathione levels may indicate oxidative stress.

The present study observed increase in the TSH levels and normal levels of T4. Our study results are in consonance with the studies around the world that shows there is association of TSH with the T2DM [19,20]. Interestingly, the present one observed in addition, there

is a substantial connection between insulin and TSH in T2DM subjects.

Conclusion

Increased insulin and TSH levels may prevent serum and tissue pathology. Increasing insulin and TSH separately or together may do this. Insulin and TSH promote insulin sensitivity, and antioxidant action. Increasing insulin or TSH levels alone or together may cause this and regardless of whatever level improves first, it is possible.

References

1. Wolf P, Dormoy A, Maione L, Salenave S, Young J, Kamen icky P, Chanson P. Impairment in insulin secretion without changes in insulin resistance explains hyperglycemia in patients with acromegaly treated with pasireotide LAR. Endocrine Connections. 2022 Dec 1;11(12).

2. Santo Leri D, Titchenell PM. Resolving the paradox of hepatic insulin resistance. Cellular and molecular gastroenterology and hepatology. 2019 Jan 1;7(2):447-56.

3. Beverly JK, Budoff MJ. Atherosclerosis: Pathophysiology of insulin resistance, hyperglycemia, hyperlipidemia, and inflammation. Journal of diabetes. 2020 Feb 1;12(2):102-4.

4. Andreadi A, Bellia A, Di Daniele N, Meloni M, Lauro R, Della-Morte D, Lauro D. The molecular link between oxidative stress, insulin resistance, and type 2 diabetes: A target for new therapies against cardiovascular diseases. Current Opinion in Pharmacology. 2022 Feb 1; 62:85-96.

5. Ibrahim MA, Isah MS, Ibrahim S. Inhibition of JAK-STAT and NF-κBsignalling systems could be a novel therapeutic target against insulin resistance and type 2 diabetes. Life sciences. 2019 Dec 15; 239 :117045.

6. Sasaki N, Ozono R, Higashi Y, Maeda R, Kihara Y. Association of insulin resistance, plasma glucose level, and serum insulin level with hypertension in a population with different stages of impaired glucose metabolism. Journal of the American Heart Association. 2020 Apr 9;9(7): e015546.

7. Kua KL, Hu S, Wang C, Yao J, Dang D, Sa Watzke AB, Segar JL, Wang K, Norris AW. Fetal hyperglycemia acutely induces persistent insulin resistance in skeletal muscle. Journal of Endocrinology. 2019 Jul 1;242(1):M1-5.

8. Wondmkun YT. Obesity, insulin resistance, and type 2 diabetes: associations and therapeutic imply cations. Diabetes, metabolic syndrome and obesity: targets and therapy. 2020; 13:3611.

9. Di Pino A, DeFranzo RA. Insulin resistance and atherosclerosis: implications for insulin-sensitizing agents. Endocrine reviews. 2019 Dec;40(6):1447-67.

10. Cortés-Rojo C, Vargas-Vargas MA, Olmos-Orizaba BE, Rodríguez-Orozco AR, Calderón-Cortés E. Interplay between NADH oxidation by complex I, glutathione redox state and sirtuin-3, and its role in the development of insulin resistance. Biochimica et BiophysicaActa (BBA)-Molecular Basis of Disease. 2020 Aug 1;1866(8):165801.

11. Zalewska A, Szarmach I, Żendzian-Piotrowska M, Maciejczyk M. The effect of N-acetylcysteine on respiratory enzymes, ADP/ATP ratio, glutathione metabolism, and nitrosative stress in the salivary gland mitochondria of insulin resistant rats. Nutrients. 2020 Feb 12;12(2):458.

12. Kumar P, Liu C, Hsu JW, Chacko S, Minard C, Jahoor F, Sekhar RV. Glycine and N-acetylcysteine

(GlyNAC) supplementation in older adults improves glutathione deficiency, oxidative stress, mitochondrial dysfunction, inflammation, insulin resistance, endothelial dysfunction, genotoxicity, muscle strength, and cognition: Results of a pilot clinical trial. Clinical and Translational Medicine. 2021 Mar;11(3): e372.

13. Yaribeygi H, Atkin SL, Sahebkar A. A review of the molecular mechanisms of hyperglycemia-induced free radical generation leading to oxidative stress. Journal of cellular physiology. 2019 Feb;234(2):1300-12.

14. Gilani SJ, Bin-Jumah MN, Al-Abbasi FA, Nadeem MS, Afzal M, Sayyed N, Kazmi I. Fustin ameliorates hyperglycemia in streptozotocin induced type-2 diabetes via modulating glutathione/Superoxide dismutase/Catalase expressions, suppress lipid peroxidation and regulates histopathological changes. Saudi Journal of Biological Sciences. 2021 Dec 1;28(12):6963-71.

15. Sankar Narayanan C, Kalaivani K. Isopulegol mitigates hyperglycemia mediated oxidative and endoplasmic reticulum stress in HFD/STZ induced diabetic rats. Archives of Medical Research. 2020 Apr 1;51(3):204-14.

16. Sahab KS, Al-Saadi AS. Relation of Homocysteine with Malondialdehyde and Dyslipidemia in Type 2 Diabetic Patients with Coronary Artery Diseases. Indian Journal of Forensic Medicine & Toxicology. 2020 Apr 29;14(2):1676-80.

17. Zaki M, Kamal S, El-Bassyouni H, Mona AbdElmotaleb AH, Tawfeek HM, Girgiss MW. Osteopontin, malondialdehyde and interleukin-1β levels in patients with insulin resistance and dyslipidemia in obese Egyptian women. Biomedical and Pharmacology Journal.2020 Jun 25;13(2):591-6.

18. El gazar EH, Esheba NE, Shalaby SA, Mohamed WF. Thyroid dysfunction prevalence and relation to glycemic control in patients with type 2 diabetes mellitus. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2019 Jul 1;13(4):2513-7.

19. Mehalingam V, Sahoo J, Bobby Z, Vinod KV. Thyroid dysfunction in patients with type 2 diabetes mellitus and its association with diabetic complications. Journal of Family Medicine and Primary Care. 2020 Aug;9(8):4277.

20. Yadav MK, Kumar P, Sharma P, Mohapatra TK. Evaluation of glycemic status and its correction with lipid profile, oxidative stress, and thyroid profile in Type 2 diabetic patients. Journal of DattaMeghe Institute of Medical Sciences University. 2020 Oct 1;15(4):654-8.