

RELATIONSHIP OF GLUCOSE TO THYROID DISORDER IN CHILDREN

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ABSTRACT

This study aimed to identification in children admitted in the Emergency Children's Hospital, the relationship of glucose to thyroid disorder. This study was carried-out on 60 children that divided into 3 groups that divided into 1st group consists of 20 patients of normal thyroid function and glucose level and considered as a control group, 2nd group that consists of 20 patients that suffering from hyperthyroidism and the 3rd group that, consists of 20 patients that suffering from hypothyroidism. Our study concluded that, in T1DM patients with normal thyroid function, thyroid hormone levels are closely related to glucose and lipid metabolism, so it is particularly important to detect thyroid feature in T1DM patients, which is useful for early detection and correction of bizarre thyroid function, and it might also similarly enhance the ailment of glucose and lipid metabolism and forestall the complications of T1DM. also, The results also, cleared that, in children with hyperthyroidism have a higher level of blood glucose than the normal control patients while, in hypothyroidism the blood glucose level decreased than the normal control group and the increasing level of glucose in hyperthyroidism is associated with decreasing level of Vitamin D and increasing level of serum lipids total cholesterol, serum triglycerides LDL-C, VLDL-C and increasing the Atherogenic index.

Keywords: Glucose, Thyroid disorder, Children

INTRODUCTION

Diabetes is a complex, persistent sickness requiring non-stop clinical care with multifactorial risk-reduction techniques past glycemic control. Ongoing affected person self-management training and aid are indispensable to stopping acute problems and decreasing the threat of long-term problems (American Diabetes Association , 2016 and Yuan et al., 2021).

The incidence of kind 1 diabetes mellitus (T1DM) is growing globally (Janež et al., 2020). T1DM in general happens in adolescents, with regards to the quite low incidence and fairly younger patients, the T1DM do now not get sufficient interest (Sirakaya et al., 2020). The mortality and the incidence of associated issues are excessive in sufferers with of T1DM (Desai and Deshmukh , 2020). At present, the pathogenesis of T1DM has no longer been completely clarified.



In current years, extra and extra students have paid interest to the subject of T1DM, and the lookup on the pathogenesis of T1DM is steadily deepening.

Type 1 diabetes debts 5–10% of diabetes and is due to cellular-mediated autoimmune destruction of the pancreatic b-cells however threequarters of all instances of kind 1 diabetes are recognized in persons < 18 years of age. It is described through one or extra autoimmune markers, along with islet mobile autoantibodies and autoantibodies to insulin, GAD (GAD65), the tyrosine phosphatases IA-2 and IA-2b, and ZnT8. The disorder has sturdy HLA associations, with linkage to the DQA and DQB genes. These HLA-DR/DQ alleles can be both predisposing or defensive (American Diabetes Association, 2014). The fee of β -cell destruction is pretty variable, being speedy in some humans (mainly toddlers and children) and sluggish in others (mainly adults). Autoimmune destruction of β -cells has a couple of genetic predispositions and is additionally associated to environmental elements that are nonetheless poorly defined. Although sufferers are now not normally chubby when they current with kind 1 diabetes, weight problems must now not forestall the prognosis (American Diabetes Association, 2016). These sufferers are additionally inclined to different autoimmune problems such as Hashimoto thyroiditis, celiac disease, Graves disease, Addison disease, vitiligo, autoimmune hepatitis, myasthenia gravis, and pernicious anemia (American Diabetes Association, 2014).

Autoimmune thyroid disorder is the most frequent autoimmune sickness related with diabetes, going on in 17–30% of sufferers with kind 1 diabetes (Roldan et al., 1999). At the time of diagnosis, about 25% of teens with type 1 diabetes have thyroid autoantibodies (Dost et al., 2015). Their presence is predictive of thyroid dysfunction and most usually hypothyroidism, though hyperthyroidism takes place in 0.5% of instances (Dost et al., 2015). Thyroid characteristic checks may additionally be deceptive (euthyroid in poor health syndrome) if carried out at time of analysis owing to the impact of preceding hyperglycemia, ketosis or ketoacidosis, weight loss, etc. Therefore, thyroid characteristic checks have to be carried out quickly after a duration of metabolic balance and properly glycemic control. Subclinical hypothyroidism can also be related with elevated chance of symptomatic hypoglycemia (American Diabetes, 2016) and decreased linear boom rate. Hyperthyroidism alters glucose metabolism and generally motives deterioration of metabolic manipulate (Yuan et al., 2021).

Diabetes and thyroid ailments are the two most frequent illnesses in the branch of endocrinology, and the two illnesses are intently associated (Cieluch et al., 2020). Studies (Nevo-Shenker et al., 2020) have proven that sufferers with T1DM or kind two diabetes mellitus (T2DM) may also have extraordinary thyroid function. In addition to promote the boom and improvement of tissue, thyroid hormones can additionally have an effect on the metabolism of sugar, fats and protein (Ferrari et al., 2018), and it's been stated that it participates in the improvement of T2DM (Jonsdottir et al., 2017). However, there are very few research on the relationship between thyroid

hormone ranges and glucose and lipid metabolism, specifically in T1DM youngsters with ordinary thyroid function.

Different elements have been related with the improvement of thyroid autoimmunity in the regularly occurring population, such as heredity, growing age, woman gender, puberty, oestrogen use, being pregnant and an iodine-rich eating regimen (Rose et al., 1999, Kaloumenou et al., 2008 and Strieder et al., 2008). In adults with T1DM, girl gender, growing age, and the presence of glutamic acid decarboxylase antibodies (anti-GAD) have been related with the improvement of thyroid autoimmunity (Barova et al., 2004). Also in teenagers and youth with T1DM, preceding research agree on the age and gender effect (Mantovani et al., 2007), whilst there are very restrained research on the value of the persistence of anti-GAD (Barova et al., 2004), the age at diabetes analysis (Kordonouri et al., 2002), and diabetes period (Kordonouri et al., 2005) on the improvement of thyroid antibody positivity..

The aims of this study were to identify in children admitted in the Emergency Children's Hospital from, the prevalence of thyroid antibody positivity and to determine the relationship of glucose to thyroid disorder.

Material and Methods

Ethical consideration:

Our learn about is a retrospective analysis. And the find out about conformed to the provisions of the Declaration of Helsinki (World Medical A. World Medical Association et al., 2019). This learn about has been licensed and permitted with the aid of the moral committee of our health facility and the written knowledgeable concurs have been bought from all the covered patients.

Patients

Children with T1DM who have been first off identified in our sanatorium from January 2021 to January 2022 have been selected.

The inclusion standards were:

- (I) the age used to be 6–13 years old;
- (II) the diagnostic standards of T1DM complied with applicable tips and consensus (Franz et al., 2017 and 11,12);
- (III) sufferers had been inclined to participant in this study.

The exclusion standards were:

- (I) sufferers had acute issues of diabetes such as diabetic ketoacidosis;
- (II) the sufferers had extraordinary thyroid function, that is, the electrochemiluminescence immunoassay technique used to be used in accordance with the laboratory trying out requirements of our hospital.

Patients with any abnormalities out of following levels had been excluded: free triiodothyronine (FT3) 2.8–7.1 pmol/L, free thyroxine (FT4) 12–22 pmol/L, thyroid stimulating hormone (TSH)

0.27–4.20 $\mu\text{IU/mL}$, thyroglobulin antibody 0–115.0 IU/mL , thyroid peroxidase antibody 0–34.0 IU/mL , thyroid stimulating hormone receptor antibody 0–1.750 IU/L ;

(III) the affected person additionally suffered from different endocrine gadget illnesses such as dwarfism and Cushing's syndrome;

(IV) the affected person had been taking pills that may also have an effect on the stage of thyroid hormones, such as iodine, glucocorticoids, and amidoketone;

(V) the sufferers did no longer agree to participant in this study. In addition, we chosen eighty five healthful youngsters who underwent bodily examinations in our clinic as a ordinary manage group.

The inclusion standards were:

- (I) the age was once 6–13 years old;
- (II) the effects of bodily examinations have been normal;
- (III) the youngsters had been properly knowledgeable and agree to participant in this study. The teens who did now not agree to participant in this learn about had been excluded.

Experimental design:

The sufferers have been divided into three groups:

1st group: 20 sufferers of regular thyroid feature and glucose degree and regarded as a manipulate group.

2nd group: 20 sufferers that struggling from hyperthyroidism.

3rd group: 20 sufferers that struggling from hypothyrodism.

Data series

Endocrine gurus measured height, weight and blood stress in accordance to worldwide standards. All topics have been fasting for extra than 12 h, and then venous blood used to be taken for medical evaluation the subsequent morning. Automatic biochemical analyzer was once used to measure activities biochemical indexes such as blood lipids, blood sugar, etc., electrochemiluminescence immunoassay was once used to notice FT3, FT4 and TSH levels, and high-performance liquid chromatography (Olympus AU2900, Japan).

Statistical evaluation

In this study, SPSS 23.0 statistical software program used to be used for statistical records processing, and the outcomes have been expressed as suggest \pm wellknown deviation. The contrast between the three companies used to be carried out via one-way evaluation of variance (ANVOA) used to be used for evaluation between the three groups, and the least tremendous distinction (LSD) technique used to be used for pairwise assessment of variance analysis.

In this study, $P < 0.05$ used to be viewed as being statistically different.

RESULTS AND DISCUSSION

The T1DM in youngsters is prompted through absolute lack of insulin. Due to its terrible pancreatic islet feature and giant fluctuations in blood sugar, it is extra in all likelihood that T2DM to be complex through diabetic ketoacidosis, extreme hypoglycemia, diabetic retinopathy, diabetic

nephropathy and different issues (Mendez and Umpierrez , 2017 and Chiang et al., 2018), it may additionally significantly have an effect on children's fantastic of existence and reason economic burdens on households (McKnight et al., 2015). Good glycemic manage helps to prolong or stop issues (Reddy et al., 2016). T1DM sufferers are frequently accompanied by way of dyslipidemia, and dyslipidemia is an vital danger element for cardiovascular sickness (Candler et al., 2017). Therefore, evaluating the hazard elements that have an effect on glucose and lipid metabolism problems in T1DM sufferers is particularly important.

In addition to advertising tissue differentiation, preserving the excitability of the anxious device and advertising protein synthesis (Tost et al., 2020), thyroid hormones can additionally have an effect on sugar and lipid metabolism (Tsibulnikov et al., 2020), and it participates in the improvement of a number ailments such as diabetes, coronary coronary heart sickness (Colella et al., 2020).

Several reviews (Gutch et al., 2017, Guarnizo-Poma et al., 2018 and Zarei et al., 2018) have explored the relationship between thyroid hormones and glucose and lipid metabolism in T2DM patients, and have furnish some theoretical groundwork for the cure and T2DM. it's been located in T2DM woman sufferers with ordinary thyroid function, TSH is positively correlated with TC and LDL-C, however it has no large correlation with TG and HDL-C, however in male patients, TSH and TC, TG, LDL-C and HDL-C have no apparent correlation (Zhang et al., 2020)..

1-Clinical parameters of thyroid gland diseases patients compared with control group:

The results observed in Table (1) cleared that, serum paraoxonase 1 (PON-1) decreased in hyperthyroidism and hypothyroidism groups compared with control group as it was 36 , 32.5 and 31.40 IU/L for control , hyperthyroidism and hypothyroidism patients respectively.

The T3 (IU/L) increased I hyperthyroidism as it was 3.21 IU/L compared to control group that was 0.91 IU/L and the lowest level observed in hypothyroidism that was 0.52 IU/L.

The T4 (IU/L) increased in hyprththyroidism patients that was 8.57 IU/L followed by control group and the lowest level observed in the hypothyroidism patients that was 3.003 IU/L.

The TSH level showed a higher level in hypothyroidism that was 5.60 Iμ , followed by control group and the lowest level of TSH observed in hyperthyroidism cases that 0.43.

The Vit. D level ng/dl showed a higher level in control group that was 41.40 followed by its level in hyperthyroidism that was 29.11 and the lowest Vit D level observed in hypothyroidism that, was 18.41 ng/dl.

The glucose level showed a higher level in hyperthyroidism group that was 123.48 followed by its level in control group that was 82.20 mg/dl and the lowest level was observed in hypothyroidism as its level was 18.41 mg/dl.

The calcium level showed a higher level in control group followed by its level in hyperthyroidism patients that was 8.27 and the lowest calcium level observed in hypothyroidism that was 8.17 mg/dl.

This consequences cleared that, why the adolescents struggling from hypothyroidism struggling from discount in physique weight attain and BMI. This consequences agreed with the

consequences of (Chase et al., 1990) the place they suggested that, a reduced charge of boom in teens with T1DM and subclinical hypothyroidism that elevated underneath thyroid alternative remedy solely in the prepubertal patients, in our find out about we did now not found a enormous impact of autoimmune thyroiditis on increase and BMI fame in T1DM patients. Besides, it has discovered that in T2DM sufferers with ordinary thyroid function, TSH was once positively correlated with TG and HbA1c (Jatwa et al., 2007), and it has no large correlation with FBG, LDL-C and HDL-C, whilst FT3 and FT4 had no substantial members of the family to glucose and lipid metabolism (Petrosyan, 2015). Previous research (Jang et al., 2018) have indicated that in T2DM patients, thyroid hormone stages are intently associated to glucose and lipid metabolism, however there are few research on the relationship between thyroid hormone stages and glucose and lipid metabolism in T1DM patients, particularly in T1DM kids with ordinary thyroid function. We have explored the relationship between thyroid hormone stages and blood glucose and blood lipid metabolism in young people with everyday thyroid feature and most important T1DM. The effects point out that TSH is positively correlated with LDL-C, TC and TG, negatively correlated with FT3 is negatively correlated with TG..

Table (1): Clinical parameters of hyperthyroidism and hypothyroidism cases compared to control group

clinical parameter	Control	Hyperthyroidism	Hypothyroidism
PON1(IU/L)	36 ± 21	32.5 ± 18	31.4 ± 19
T3(Iu/L)	0.91 ± 0.45	3.21** ± 0.8	0.52 ± 0.42
T4(Iu/L)	6.74 ± 1.44	8.57 ± 2.9	3.003** ± 1.26
TSH (Iu/L)	2.43 ± 1.3	0.43 ± 0.79	5.6** ± 2.6
ViT.D (ng/dl)	41.4 ± 11.96	29.11** ± 12.5	18.41** ± 10.6
Glucose (mg /dl)	82.2 ± 9.0	123.48** ± 53.6	18.41** ± 10.6
Calcium (mg /dl)	9.08 ± 0.7	8.27** ± 53.6	8.17** ± 1.06

** Significant difference at (P < 0.01).

*** Significant difference at (P < 0.001).

2-Serum lipids level among hyperthyroidism and hypothyroidism cases compared to control group:

The results observed in table (2) cleared that, there was a significant differences of the levels of serum lipids level (Total cholesterol, triglycerides, HDL-C, LDL-C, VLDL-C and Atherogenic index) among different groups (P < 0.01).

The Total cholesterol mg/dl level showed a higher level in hyperthyroidism that was 243.13 followed by control group that was 226.447 and the lower level observed in hypothyroidism that was 165.13 mg/dl.

The triglycerides level mg/dl showed a higher level in hyperthyroidism that was 207.96

followed by control group that was 173.17 and the lower level observed in hypothyroidism that was 149.89 mg/dl.

The **HDL-C** level mg/dl showed a higher level in hyperthyroidism that was 161.97 mg/dl followed by control group that was 146.41 mg/dl and the lower level observed in hypothyroidism that was 81.49 mg/dl.

The **LDL-C** level mg/dl showed a higher level in hyperthyroidism that was 161.97 mg/dl followed by control group that was 146.41 mg/dl and the lower level observed in hypothyroidism that was 81.49 mg/dl.

The **VLDL-C** level mg/dl showed a higher level in hyperthyroidism that was 41.59 mg/dl followed by control group that was 33.92 mg/dl and the lower level observed in hypothyroidism that was 30.14 mg/dl.

The Atherogenic index level showed a higher level in hyperthyroidism that was 6.48 mg/dl followed by control group that was 5.34 mg/dl and the lower level observed in hypothyroidism that was 3.06.

When sufferers with T1DM are in a nation of hyperglycemia, insulin secretion is distinctly insufficient, and the body's glucose metabolism undertaking is reduced, the strength utilization of thyroid follicular cells is reduced, which motives iodine pump dysfunction and the thyroid's response to TSH is decreased (Karar et al., 2015 and Ahi et al., 2019). It reduces the thyroid hormone synthesis, which in flip impacts the exercise of 5'-deiodinase, and FT3 stages are decreased (Finan et al., 2016).

Table (2): Serum lipids level among hyperthyroidism and hypothyroidism cases compared to control group

Clinical parameters	Control	Hyperthyroidism	Hypothyroidism
Total cholesterol mg/dl	226.447 ± 68.05	243.13 ± 33.33	***165.13 ± 25.39
Triglycerides mg/dl	173.17 ± 81.43	***207.96 ± 42.52	149.89 ± 38.84
HDL-C mg/dl	46.13 ± 9.74	40.13 ± 9.55	***52.31 ± 10.37
LDL-C mg/dl	146.41 ± 78.5	161.97 ± 34.24	***81.49 ± 28.47
VLDL-C mg/dl	33.92 ± 17.22	***41.59 ± 8.5	30.14 ± 10.28
Atherogenic index	5.34 ± 2.5	6.48 ± 1.96	***3.06 ± .98

** Significant difference at (P < 0.01).

*** Significant difference at (P < 0.001).

3-Relationships between serum glucose and thyroid disorders and their relations with

serum constituents:

The results also, cleared that, in children with hyperthyroidism have a higher level of blood glucose than the normal control patients while, in hypothyroidism the blood glucose level decreased than the normal control group and the increasing level of glucose in hyperthyroidism is associated with decreasing level of Vitamin D and increasing level of serum lipids total cholesterol, serum triglycerides LDL-C, VLDL-C and increasing the Atherogenic index.

These consequences attributed to, when blood glucose is poorly managed for a lengthy time, the physique is in an apparent metabolic disorder, which can also not directly have an effect on the feature of the hypothalamic pituitary thyroid axis device (Amouzegar et al., 2015). Insensitivity leads to a reduce in TSH secretion. FT3 impacts the antilipolytic impact of insulin, ensuing in a large make bigger in free FFA awareness and an extend in TG synthesis (Delitala et al., 2017). In addition, when TSH increases, though the synthesis of ldl cholesterol decreases, the price of excretion is lower, which will increase the attention of LDL-C, TC and TG in the blood (Zhu et al., 2010), however the precise mechanism desires to be similarly studied. The modern-day learn about located that diabetes mixed with ordinary thyroid hormone is often manifested by means of the discount of TSH and/or T3 levels, and the modifications of T4 are ordinarily insignificant. This find out about additionally located in sufferers with T1DM, in contrast with the wholesome manipulate group, TSH and FT3 are reduced, and FT4 has no apparent changes. Some students (Wolide et al., 2017 and Jayanthi et al., 2017) trust that this phenomenon is a kingdom of low metabolism in the body. To keep away from consumption precipitated by using immoderate metabolism, a law or protection mechanism can also link, in addition researches on the unique mechanism is nonetheless needed. The modern find out about has observed that diabetes mixed with atypical thyroid hormone is in most cases manifested via the discount of TSH and/or T3 levels. This learn about additionally discovered in sufferers with T1DM, in contrast with the healthful manage group, TSH and FT3 are reduced, and FT4 has no apparent changes. Some researches on blood lipids and kind 1 diabetes have made some progress, however there is no unified conclusion on the relations. Further researches are wished to perceive the molecular biology and pathophysiological mechanisms.

In conclusion, we have observed that in T1DM sufferers with ordinary thyroid function, thyroid hormone tiers are intently associated to glucose and lipid metabolism, so it is in particular essential to observe thyroid characteristic in T1DM patients, which is useful for early detection and correction of atypical thyroid function, and it might also in addition enhance the sickness of glucose and lipid metabolism and stop the problems of T1DM. also, The effects also, cleared that, in teens with hyperthyroidism have a greater degree of blood glucose than the regular manipulate sufferers while, in hypothyroidism the blood glucose stage diminished than the regular manipulate team and the growing degree of glucose in hyperthyroidism is related with lowering stage of Vitamin D and increasing stage of serum lipids complete cholesterol, serum triglycerides LDL-C, VLDL-C and growing the Atherogenic index.

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