A retrospective study of thyroid hormone in Pediatrics: relationships with growth hormone correlation with effects of diabetes in Riyadh, Saudi Arabia

Faisal Mujeb Alshareef (1)
Abdullah Hamad Alfaris (1)
Nouryah Abdulaziz Alhafez (2)
Alanoud Saleh Albuloshi (3)
Abdulaziz Mshaal Aljuhni (4)
Khalid Abdulrahman Almahmoud (4)
Majed Abdulaziz Almajdui (5)
Khalid Ebrahim Alswayed (4)
Saad Ibrahim Alghuraybi (4)
Saleh Abdulmoneim Alomary (4)
Abdullah Ahmad Alkhudher (4)
Faisal Turki G Alharbi (4)
Mohammed Ahmed Almuhanna (4)
Musaad Abdulaziz Alrashod (6)
Khalid Ahmed Aljasser (6)

(1) Pediatric Endocrinologist Consultant, Security Force Hospital, Riyadh, Saudi Arabia
(2) Medical Intern, Vision University, Riyadh, Saudi Arabia
(3) Medical Intern, Almaarefa University, Riyadh, Saudi Arabia
(4) Medical Student, Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia
(5) Medical Intern, Hunan Normal University, Changsha, China
(6) Medical Intern, Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia

Corresponding author:
Khalid Almahmoud
Medical Student, Imam Mohammad Ibn Saud Islamic University,
Riyadh, Saudi Arabia
Tel:0565672203
Email: Dr.almahmoud@outlook.com

Received: September 2021; Accepted: October 2021; Published: November 1, 2021.
Citation: Faisal Mujeb Alshareef et al. A retrospective study of thyroid hormone in Pediatrics: relationships with growth hormone correlation with effects of diabetes in Riyadh, Saudi Arabia World Family Medicine. 2021; 19(11): 42-46 DOI: 10.5742/MEWFM.2021.94157

Abstract

Background: Inadequate Thyroid Hormone at birth in newborns is known as Congenital Hypothyroidism (CH) and it has a critical role in their growth and brain development. As a result, untreated CH and abnormal GH/IGF1 levels can lead to failure to thrive, osteoporosis, and Diabetic Retinopathies, among other problems. This retrospective study examines the chances of developing growthhormone disruption and Diabetes Mellitus in patients diagnosed with Congenital Hypothyroidism at the Security Forces Hospital in Riyadh, Saudi Arabia.

Methodology: A retrospective chart review of growth hormone deficient (GHD) patients was done at the security force hospital in Riyadh, Saudi Arabia. The data was collected from the medical records of the patients. The study included all patients with growth hormone deficiency (GHD) who had complete clinical, diagnostic and treatment data.

Result: At the beginning of the research, 287 growth hormone-deficient (GHD) children ranging in age from 1 to 15 years old were evaluated for diabetes. A total of 151 (52.6%) of the 287 patients gotlevothyroxine therapy, while the remaining 136 (47.4%) did not (control group). Because the p-value <0.05 ($t(149) = 1.165$, $p = 0.246$), the mean difference in blood sugar level changes is not statistically significant ($t(149) = 1.165$, $p = 0.246$).

Conclusion: We found that levothyroxine therapy has no discernible effect on blood sugar level fluctuations in males and females.

Key words: Growth hormone deficiency, Kingdom of Saudi Arabia, Diabetes.

Introduction

Thyroid Hormone has a crucial role in an infant's growth and neurological development, hence its essentiality in the Myelin Sheath formation process (1) (2). Especially in the early years of an infant's life, the Disturbance of Thyroid Hormone function results in irremediable neurocognitive impairment (2). Inadequacy of Thyroid Hormone at birth in newborns is known as Congenital Hypothyroidism(CH), and worldwide it is one of the most common endocrinal disorders in this age group (1) (3). In Saudi Arabia, literature presents higher CH incidence rates in comparison to the world population (4) (3) (5). In addition to thyroid hormone physiology, it stimulates the secretion of Growth hormone(GH), insulin-like growth factor 1(IGF1) production, and bone maturation (2). Thereby, untreated CH and disturbed GH/IGF1 levels can lead to other complications of failure to thrive, osteoporosis, and Diabetic Retinopathies (2) (6). Diabetes Mellitus (DM) is one of the most common endocrine disorders in children (7). Although the exact cause of type 1 DM is idiopathic, Type 2 DM is related to Obesity (8). Hyper-secretion of growth hormone in relation to Diabetes was related to insulin resistance development, impaired metabolic control, and growth deterioration in insulin-dependent DM (9) (10). In the pediatric age group worldwide, a dramatic increase of DM Type 2 is reported with higher mortality of DM type 2 in relation to DM Type 1 (8). The World Health Organization ranks Saudi Arabia as second highest in the middle east and as 7th worldwide in the prevalence of Diabetes (11). Both endocrine disorders of Hypothyroidism and Diabetes are common and can be easily misdiagnosed clinically, which increases the risk of complications if not properly diagnosed and treated early (7). Since November 1989, the Saudi national newborn screening program for Congenital Hypothyroidism has been conducted (4). Since early diagnosis and intervention has a better outcome on patient health, this study is looking retrospectively for risks of developing growth hormone disturbance and Diabetes Mellitus inpatients diagnosed with Congenital Hypothyroidism at Security Forces Hospital in Riyadh, Saudi Arabia.

Methodology

(GHD) patients was done at the Security Forces Hospital in Riyadh, Saudi Arabia. In the Security Forces Hospital, children aged from 1 to 15 years were diagnosed with growth hormone deficiency (GHD). At the beginning of the study, 273 growth hormone deficient (GHD) children ranging in age from 1 to 15 years old had their blood sugar levels checked. Patients with missing or partial data were not included in the study.

The information was gathered from the medical records of the patients. All patients with growth hormone deficiency (GHD) who had complete clinical, diagnostic, and therapy data were included in the study. Patients' demographics, clinical features, investigations, and therapy parameters were among the variables. The method for determining was whether there were any links that exist between developing growth hormone disturbance and Diabetes Mellitus in patients diagnosed with Congenital Hypothyroidism. The Institutional Review Board (IRB) of the Security Forces Hospital in Riyadh city authorized this study under the IRB code H-01-R-069 (11, 4, 2021).

The JMP statistical program was used to conduct the statistical analysis. To characterize and present the research variables, descriptive statistics analysis was used. For continuous variables, mean and standard deviation were calculated.

Results

A total of 287 growth hormone-deficient (GHD) children with the age range of 1 to 15 years old were investigated for Diabetes. On average, the children were enrolled in the study at eight years old (SD = 2.53) and completed at 14 years old (SD = 2.34). This shows that, on average, each child's Diabetes was measured at 3.44 years of age (SD = 2.26). At the beginning of the study, the mean blood sugar level was 135.0 mg/dL (SD = 15.48) and recorded to increase to 140.7 (SD = 16.39) at the end of the study.

A total of 151 (52.6%) of the 287 patients were given levothyroxine medication, whereas the remaining 136 (47.3%) were not (control group).

We wanted to see if there was a substantial difference in blood sugar level changes between the treatment and control groups in this study.

The null and alternative hypotheses for this study hypothesis are as follows:
H0: The variations in blood sugar levels in the treatment and control groups are not significantly different.
H1: The differences in blood sugar levels between the treatment and control groups are significantly different.
To test this hypothesis, an independent sample t-test is used, assuming that the variances of the treatment and control groups are equal.

This is supported by Levene's test for equality of variance testing.

Because the p-value is not less than 0.05 ($F = 0.001$, $p = 0.991$), the changes in blood sugar levels for the treatment and control groups had equal variances.

Table 2 shows that the changes in blood sugar level were higher among patients who received the treatment ($M = 6.169$, $SD = 20.83$) than those who did not receive the treatment ($M = 5.271$, $SD = 21.36$). However, because the p-value is more than 0.05, the t-test reveals that the mean difference between the two groups was not statistically significant ($t(285) = 0.360$, $p = 0.719$).

This demonstrates that there is no substantial difference in blood sugar fluctuations between patients who received growth hormone treatment and those who did not (Table 2).

Table 1. Summary statistics

Variable		N	Mean	Std. Deviation	Minimum	Maximum
Age (years)	Study start	273	8.21	2.53	1	15
	Study end	273	14.11	2.34	3	18
	Study Duration	273	3.44	2.26	1	12
Blood Sugar Level (mg/dL)	Study start	273	135.0	15.48	110.3	162.6
	Study end	273	140.7	16.39	112.1	169.0
	Changes	273	4.937	22.79	-48.89	55.15

Table 2. Results for independent t-test on blood sugar level changes between treatment and control group

Group	N	Mean	Std. Deviation	Mean Difference	t-test		
					t-value	df	p-value
Control	151	6.169	20.83	0.897	0.360	285	0.719
Treatment	136	5.271	21.36				

An independent t-test is further carried out to see whether there is a significant difference in the changes in blood sugar level among treatment groups based on gender. Among the treatment group, 79 (52%) patients were identified as males, and 72 (48%) were females. Figure 3 shows that the males have just slightly lower changes in sugar blood levels as compared to females. A formal test with the independent t-test can be confirmed whether this difference between males and females is significant or not.Because the p-value is greater than 0.05 ($F = 2.483$, $p = 0.117$), Levene's test implies that the independent t-test for comparing variations in blood sugar levels between males and females should be conducted under the premise of equal variances. Because the p-value is more than 0.05 ($t(149) = 1.165$, $p = 0.246$), the independent t-test shows that the mean difference in blood sugar level changes is not statistically significant ($t(149) = 1.165$, $p = 0.246$). As a result, we may infer that levothyroxine medication has no discernible effect on blood sugar level variations in males and females.

Table 3. Results for independent t-test on changes in blood sugar level between males and female

Gender	N	Mean	Std. Deviation	Mean Difference	t-test		
					t-value	df	p-value
Male	79	4.285	18.61	3.950	1.165	149	0.246
Female	72	8.235	22.97				

Discussion

The study purpose was to determine whether there are any links that exist between developing growth hormone disturbance and Diabetes Mellitus in patients diagnosed with Congenital Hypothyroidism at Security Forces Hospital in Riyadh, Saudi Arabia, and it was done retrospectively, the findings of our study revealed that out of 287 patients, 151 (52.6%) received levothyroxine treatment and the rest 136 (47.4%) did not receive the treatment (control group) and that the changes in blood sugar level were higher among patients who received the treatment (M = 6.169, SD = 20.83) than those who did not receive the treatment (M = 5.271, SD = 21.36). And this can be supported by another study that found similar results. This might be explained by how levothyroxine affects insulin resistance (15). We also conclude that levothyroxine treatment does not make any significant difference in blood sugar level changes between males and females. There is a link between Thyroid gland and Diabetes; it has been displayed that they both affect each other and there is an association between the conditions. Thyroid hormones also have a role in the regulation of carbohydrate metabolism and pancreatic function (13). However, we found that there was no significant difference in the changes of blood sugar level between patients who were treated with growth hormone and those who were not. Even though GH is well known to have effects on glucose metabolism, GH increases glucose production through gluconeogenesis and glycogenolysis from the liver and kidney (14). Males who are Growth deficient have a slow growth velocity, as compared to females who displayed an acceleratory trend (15). Pediatric Diabetes is increasing internationally; the World Health Organization rank Saudi Arabia at 7th in prevalence and 5th in incidence of type 1 diabetes (16).A study conducted in King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia, concluded that because of the increasing endocrine disorders, more pediatricians need to be trained to meet the requirement (17). Diabetes patients should be screened for thyroid abnormality when are clinically stable or once getting glycemic control; also every 1-2 years unless the patient develops thyroid disorder symptoms such as thyromegaly, an abnormal growth rate, or glycemic changes (16). Type 1 diabetes and hypothyroidism are common but they can be missed on initial presentation (18). Screening of the neonatal helps with early diagnosis and management of asymptomatic infants (19). When treating patients that are type 1 diabetic and growth hormone-deficient there are some challenges, but growth hormone treatment is considered safe and effective (20).

Conclusion

In our research, we found that patients who received levothyroxine therapy have increased their blood sugar level compared to patients who did not receive the treatment and we also found that levothyroxine treatment does not make any significant difference in blood sugar level changes between males and females.

References

(1) Abdelmoktader AM. Risk factors for congenital hypothyroidism in Egypt: Results of a population case-control study (2003–2010). Annals of Saudi medicine 2013;33(3):273-276.
(2) Minamitani K. Newborn Screening for Congenital Hypothyroidism in Japan. International Journal of Neonatal Screening 2021;7(3):34.
(3) Abbas M, Tayrab E, Elmakki A, Tayrab J, Al-Shahrani A, Miskeen E, et al. Primary thyroid stimulating hormone screening for congenital hypothyroidism in king abdullah hospital, bisha, saudi arabia. Cureus 2020;12(3).
(4) Al Shaikh A, Alsofyani A, Shirah B, Al Noaim K, Ahmed ME, Babiker A, et al. Congenital hypothyroidism in Saudi population in two major cities: A retrospective study on prevalence and therapeutic outcomes. International Journal of Health Sciences 2021;15(1):17.
(5) Al Juraibah F, Alothaim A, Al Eyaid W, AlMutair AN. Cord blood versus heel-stick sampling for measuring thyroid stimulating hormone for newborn screening of congenital hypothyroidism. Annals of Saudi medicine 2019;39(5):291-294.
(6) Holly J, Amiel SA, Sandhu RR, Rees LH, Wass J. The role of growth hormone in diabetes mellitus. J Endocrinol 1988;118(3):353-364.
(7) Seth A, Maheshwari A. Common endocrine problems in children (hypothyroidism and type 1 diabetes mellitus). The Indian Journal of Pediatrics 2013;80(8):681-687.
(8) Alaqeel AA. Pediatric diabetes in Saudi Arabia: Challenges and potential solutions. A review article. International Journal of Pediatrics and Adolescent Medicine 2019;6(4):125-130.
(9) Dunger DB, Cheetham TD. Growth hormone insulin-like growth factor I axis in insulin-dependent diabetes mellitus. Hormone Research in Paediatrics 1996;46(1):2-6.
(10) Bonfig W, Lindberg A, Carlsson M, Cutfield W, Dunger D, Camacho-Hübner C, et al. Efficacy of growth hormone treatment in children with type 1 diabetes mellitus and growth hormone deficiency—An analysis of KIGS data. J Pediatr 2018;198:260-264.
(11) Alwin Robert A, Abdulaziz Al Dawish M, Braham R, Ali Musallam M, Abdullah Al Hayek A, Hazza Al Kahtany N. Type 2 diabetes mellitus in Saudi Arabia: major challenges and possible solutions. Current diabetes reviews 2017;13(1):59-64.
12- Mazaheri T, Sharifi F, Kamali K. Insulin resistance in hypothyroid patients under Levothyroxine therapy: a comparison between those with and without thyroid autoimmunity. J Diabetes Metab Disord. 2014 Oct 30;13(1):103. doi: 10.1186/s40200-014-0103-4. PMID: 25364704; PMCID: PMC4216656.
13- Hage M, Zantout MS, Azar ST. Thyroid disorders and diabetes mellitus. J Thyroid Res. 2011;2011:439463. doi: 10.4061/2011/439463. Epub 2011 Jul 12. PMID: 21785689; PMCID: PMC3139205
14- Kim SH, Park MJ. Effects of growth hormone on glucose metabolism and insulin resistance in human. Ann Pediatr Endocrinol Metab. 2017;22(3):145-152. doi:10.6065/apem.2017.22.3.145

15- Ganvir RH, Bhalla AK, Dayal D. Growth attainments of Indian children with type 1 diabetes: a mixed longitudinal study. Indian J Pediatr. 2015 Mar;82(3):245-52. doi: 10.1007/s12098-014-1466-8. Epub 2014 May 15. PMID: 24827083.
16- Alaqeel AA. Pediatric diabetes in Saudi Arabia: Challenges and potential solutions. A review article. Int J Pediatr Adolesc Med. 2019;6(4):125-130. doi:10.1016/j.ijpam.2019.05.008
17- Al jurayyan, Nasir. (2012). Spectrum of endocrine disorders at the Paediatric Endocrine Clinic, King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia. Journal of Taibah University Medical Sciences. 7. 99–103. 10.1016/j.jtumed.2012.10.002.
18- Seth A, Maheshwari A. Common endocrine problems in children (hypothyroidism and type 1 diabetes mellitus). Indian J Pediatr. 2013 Aug;80(8):681-7. doi: 10.1007/s12098-013-1101-0. Epub 2013 Jun 29. PMID: 23813150.
19- Shaikh AA, Alsofyani A, Shirah B, et al. Congenital hypothyroidism in Saudi population in two major cities: A retrospective study on prevalence and therapeutic outcomes. Int J Health Sci (Qassim). 2021;15(1):17-21.
20- Bonfig, Walter & Holl, Reinhard. (2019). Mini Review/Commentary: Growth Hormone Treatment in Children with Type 1 Diabetes. International Journal of Molecular Sciences. 20. 772. 10.3390/ijms20030772.