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ORIGINAL ARTICLE

Assessment of Serum Level of Selenium and Zinc in Children with Dysfunctional Thyroid Disorders

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Abstract

Background: There is biological plausibility to the link between trace element levels and thyroid hormone metabolism. While some studies found higher concentrations of trace elements in the blood of dysfunctional thyroid patients, others found lower levels. Therefore, it became mandatory to formulate an idea about the circulating levels of selected trace elements as selenium (Se) and zinc (Zn) in children with dysfunctional thyroid disorders. **Aim:** To investigate the association between dysfunctional thyroid disorders and selected trace elements Se and Zn concentrations in children. **Methods:** This study was a cross-sectional study conducted at the pediatrics department and outpatient clinics of pediatric endocrinology unit, Zagazig University Hospital in the period of about 1.5 year. This study included 300 participants who were evaluated regarding thyroid function, 210 of them had proven dysfunctional thyroid disorder while 90 subjects were healthy individuals. Zn, Se, thyroid function and thyroid antibodies were measured in all children. **Results:** Regarding trace elements, acquired hypothyroidism group and congenital hypothyroidism group showed significant lower mean zinc level when compared to control group. Also acquired hypothyroidism group showed significantly lower mean Selenium level when compared to control group. **Conclusion:** Selenium and zinc deficiency was found in children who were found to have dysfunctional thyroid disorders.

Keywords: Selenium, Zinc, Children, Dysfunctional Thyroid Disorders.

INTRODUCTION

Thyroid dysfunction of which hypothyroidism is the most prevalent kind is one of the hormonal abnormalities that affect children the most throughout the world. Abnormal amounts of thyroid hormones in the bloodstream are indicative of thyroid dysfunction **[1].**

Thyroid hormones affect almost every type of cell in the body. It works by raising the basal metabolic rate, influencing protein synthesis, assisting in the regulation of brain maturation and long bone growth (in conjunction with growth hormone), and increasing permissiveness, which makes the body more sensitive to catecholamines like adrenaline. All of the body's cells require the thyroid hormones for healthy development and differentiation **[2].**

Thyroid hormones also control the metabolism of fat, protein, and carbohydrates, which has an impact on how energy molecules are used by human cells. They also cause the production of heat and increase vitamin metabolism. Thyroid hormone production is influenced by a wide range of physiological and pathological factors. A few trace minerals, such as zinc (Zn) and selenium (Se),

are necessary for the production and metabolism of thyroid hormones **[3].**

Se, which is integrated into selenoproteins, is highly concentrated in the thyroid gland. Certain selenoproteins exhibit significant antioxidant properties, aiding the thyroid's antioxidant defense mechanism by eliminating oxygen free radicals produced during thyroid hormone synthesis **[4].**

In terms of thyroid disease, autoimmune illnesses have been specifically linked to selenium consumption. Supplementing with selenium in patients with Graves' orbitopathy has been linked to improved quality of life, increased involvement of the eyes, and a delay in the development of ocular diseases **[5].**

It has been suggested that zinc is necessary for the thyroid to function at its best. It is essential to the healthy conversion of thyroid hormones. Zn has also been found to be a cofactor for the enzyme that produces thyrotropin-releasing hormone, which is essential to the release and functioning of thyroid hormone **[6].**

There is biological plausibility to the link between trace element levels and thyroid hormone metabolism. While some studies found higher concentrations of trace elements in the blood of dysfunctional thyroid patients, others found lower levels. Therefore, it became mandatory to formulate an idea about the circulating levels of selected trace elements as selenium (Se) and zinc (Zn) in children with dysfunctional thyroid disorders.

So, we aimed to investigate the association between dysfunctional thyroid disorders and selected trace elements Se and Zn concentrations in children.

SUBJECTS AND METHODS

This study was a cross-sectional study conducted at the pediatrics department and outpatient clinics of pediatric endocrinology unit, Zagazig University Hospital in the period of about 1.5 year. This study included 300 participants who were evaluated regarding thyroid function and showed that 177(59%) participants have acquired hypothyroidism were classified into clinical hypothyroidism group 96(32%) and subclinical hypothyroidism group 81(27) %. And 33(11%) have congenital hypothyroidism and 90(30%) participants were in the control group.

Informed written consent was obtained from patents of each participant sharing the study. Study protocol was approved by the research ethical committee and the institutional review board (IRP)number (6811/3/21) of faculty of medicine, Zagazig University.

Inclusion criteria included age below 18 years, both sexes and children with proven dysfunctional thyroid disorder based on clinical and laboratory evidence. Exclusion criteria included children with CNS or congenital problems and children receiving multivitamins and minerals in the last 6 months.
All children underwent a thorough history taking, a comprehensive clinical examination, and laboratory tests including serum Zn, Se, thyroid function and thyroid antibodies.

Sample size:
If all cases met the inclusion and exclusion criteria were included in the study. During the study period (6 months), 50 cases/month, so 300 cases were included as a comprehensive sample.

Samples collection

Four ml of venous blood from every patient was collected in a sterile tube. The tubes clearly displayed all the participating children's information, including their name, age, sex, serial number, and sample collection date. Blood samples were left 1 hour to be clotted then the samples were centrifuged for 15 min in the centrifugation device of the central laboratory of Zagazig University Hospitals. The resulting serum samples (1ml) were separated and stored in Eppendorf tubes at −80°C till the time of assay.After processing and digestion of the samples, each sample was divided into 2 divisions for measuring zinc and selenium levels. Zinc and selenium concentrations in serum samples were measured by Buckscientific 210VGP Atomic Absorption Spectrophotometer" at the Faculty of Veterinarymedicine, Zagazig University.

STATISTICAL ANALYSIS

The software called Statistical Package for the Social Sciences (SPSS version 20) was used to import the data and analyze them. As stated by Hamburg (1979). Chi-square and t tests were the two tests that were used.

RESULTS

This study included 300 participants who were evaluated regarding thyroid function and the results showed that 177 (59%) participants have acquired hypothyroidism and 33 (11%) have congenital hypothyroidism and 90 (30%) participants were in the control group.

There was statistically significant difference between the studied groups regarding BMI, where acquired hypothyroidism group showed higher mean BMI followed by congenital hypothyroidism group, then control group, also there was statistically significant difference between the control group and both acquired hypothyroidism group and congenital hypothyroidism group regarding BMI while there was non-statistically significant difference between the acquired hypothyroidism group and congenital hypothyroidism group. Although there was non-statistically significant difference between the studied groups regarding weight and height ($p>0.05$) but acquired hypothyroidism group showed significant higher weight and lower height when compared to control group (Table 1).

There was statistically significant difference between the studied groups regarding thyroid function (T4 & TSH), trace elements (zinc and selenium) and thyroid antibodies (ATP & ATG). Regarding thyroid function, acquired hypothyroidism group and congenital hypothyroidism group showed significant lower mean T4 level when compared to control group, also both acquired hypothyroidism group and congenital hypothyroidism group showed statistically significant increase in TSH level when compared to control group. Regarding thyroid antibodies, congenital hypothyroidism group showed significantly higher levels of ATP and ATG antibodies when compared to both acquired hypothyroidism group and control group. Regarding trace elements, acquired hypothyroidism group and congenital hypothyroidism group showed significantly lower mean zinc level when compared to control group. Also, acquired hypothyroidism group showed significantly lower mean Selenium level when compared to control group (Table 2).

Regarding family history, there was a statistically significant difference between the groups under study of hypothyroidism as (42.4%) of congenital hypothyroidism group and (33.3%) of acquired hypothyroidism group's history of hypothyroidism was positive. Additionally, there was a statistically significant difference between the studied groups regarding hair loss as (42.9%) of acquired hypothyroidism group and (33.3%) of congenital hypothyroidism group clinical presentation of hair loss. Regarding constipation, congenital hypothyroidism group showed significant higher complain of constipation (30.3%) when compared to acquired hypothyroidism group (9.6%) and control group (7.8%), also congenital hypothyroidism group showed significant higher T4 (60.6%) while acquired hypothyroidism group showed higher TSH levels (78.5%). There was statistically significant difference between the studied groups regarding trace elements grades, as (36.4%) of cases with congenital hypothyroidism group showed the low Zn grade followed by acquired hypothyroidism group (19.8%), on the other hand (30.5%) of acquired hypothyroidism group showed low Selenium level followed by congenital hypothyroidism group (21.2%). Regarding thyroid antibodies, there was statistically significant difference between the studied groups regarding ATP grades as more than half of cases with congenital hypothyroidism group (54.5%) showed elevated ATP grade followed by acquired hypothyroidism group (39.5%). About (10.2%) of cases with congenital hypothyroidism group showed elevated ATG grade (Table 3).

Age, weight, height, and BMI did not differ statistically significantly between clinical and subclinical hypothyroidism group ($p>0.05$), although the distribution of gender was statistically significant (Table 4).

There was a statistically significant difference regarding thyroid function (T4 & TSH), and thyroid antibodies (ATP & ATG) between clinical and subclinical hypothyroidism group. Regarding trace elements (selenium), there was a non-statistically significant difference ($p>0.05$) between clinical and subclinical hypothyroidism group. Regarding family history, there was a statistically significant difference between clinical and subclinical hypothyroidism group, (53.1%) of clinical hypothyroidism group, and (8.6%) of subclinical hypothyroidism group's history of hypothyroidism was favorable. Additionally, there was a statistically significant difference between clinical and subclinical hypothyroidism group regarding hair loss as (49.4%) of subclinical acquired hypothyroidism group, and (37.5%) of clinical acquired hypothyroidism group presented with hair loss. Regarding constipation, subclinical acquired hypothyroidism group (9.9%) showed higher complain of constipation and subclinical acquired hypothyroidism group (9.4%). Majority of clinical acquired hypothyroidism group (80.2%) showed significant low T4 level while (80.2%) of subclinical acquired hypothyroidism group showed high TSH levels followed by (78.1%) of clinical acquired hypothyroidism group. There was no statistically significant variation with respect to Zn grade between clinical and subclinical

hypothyroidism group, as clinical acquired hypothyroidism group (20.8%) showed low Zn level and subclinical acquired hypothyroidism group (18.5%). Regarding selenium grades, there was also a non-statistically significant difference Between clinical and subclinical hypothyroidism group. Regarding thyroid antibodies, there was statistically significant difference Between clinical and subclinical hypothyroidism group, regarding ATP grades as more than half of cases with clinical acquired hypothyroidism group (55.2%) showed elevated ATP grade. About (14.6%) of cases with clinical and (4.9%) of subclinical acquired hypothyroidism group showed elevated ATG grade (Table 5).

The relationship between hair loss and zinc level was statistically significant, as hair loss cases had low zinc levels, and the relationship between hair loss and selenium level was also statistically significant. The relationship between constipation and zinc and selenium levels was not statistically significant (Table 6).

Significantly unfavorable correlations were found between TSH, zinc, and selenium levels. A noteworthy positive association was observed between the level of zinc and T4 and negative correlation between T4 and each of TSH, ATP, ATG and weight. There was significant positive correlation between zinc and selenium levels (Table 7).

Table (1): Basic characteristics of the studied groups:

Variable	Control Group (n=90)	acquired hypothyroidism group (n=177)	congenital hypothyroidism group (n=33)	Tests		
				f	P value	Post hoc
Age (years) Mean±SD Range	7.54±2.4 (5-14)	7.64±2.4 (5-16)	8±3.31 (5-16)	0.400	0.671	P1=0.760 P2=0.374 P3=0.456
Weight (kg) Mean ±SD Range	29.61±11.72 (17-56)	32.35±10.15 (17-56)	30.12±6.77 (18-56)	2.323	0.100	P1=**0.042*** P2=0.809 P3=0.257
Height Cm Mean±SD Range	115.86±9.21 (100-145)	113.11±9.53 (95-140)	114.58±15.9 (95-155)	2.148	0.119	P1=**0.041*** P2=0.543 P3=0.455
BMI Mean±SD Range	21.36±5.52 (14.52-35.84)	24.83±4.92 (14.52-38.89)	23.61±3.87 (15.09-35.84)	14.316	**<0.001***	P1<**0.001*** **P2=0.028*** P3=0.201
Variable				**x2**	**P value**	
Sex **Male**	**No**	58	111	18	1.034	0.596
	(%)	64.4%	62.7%	54.5%		
Female	**No**	32	66	15		
	(%)	35.6%	37.3%	45.5%		

F=Oneway- ANOVA test , x^2 =Chi-Square Test
P1=control group vs acquired hypothyroidism group
P2= control group vs congenital hypothyroidism group
P3= acquired hypothyroidism group vs congenital hypothyroidism group

Table (2): laboratory investigations of the studied groups:

Variable		Control Group (n=90)	acquired group (n=177)	congenital group (n=33)	Tests		
					f	P value	Post hoc
Thyroid function Mean ±SD Range	**T4 (ng/dl)**	1.3±0.28 (0.8-1.7)	0.96±0.51 (0.2-1.7)	1±0.5 (0.2-1.6)	17.773	<0.001*	P1<0.001* P2=0.001* P3=0.639
	TSH (mIU/L)	3.7±0.76 (2.4-5)	18.06±20.62 (6.12-150)	15.04±13.52 (6.12-56)	22.817	**<0.001***	P1**<0.001*** **P2=0.001*** P3=0.335
Thyroid antibodies Mean ±SD Range	**ATP**	17.19±7.12 (9-30)	34.63±13.73 (15-70)	39.82±10.1 (18-50)	78.900	**<0.001***	**P1<0.001*** **P2<0.001*** **P3=0.021***
	ATG	24.04±4.27 (18-33)	30.19±6.15 (21-41)	33.06±4.5 (23-39)	49.380	**<0.001***	**P1<0.001*** **P2<0.001*** **P3=0.006***
Trace elements Mean ±SD Range	**Zinc**	1.08±0.31 (0.54-1.69)	0.99±0.36 (0.42-2.01)	0.9±0.4 (0.46-1.69)	3.975	**<0.001***	P1=**0.032*** **P2=0.011*** P3=0.203
	Selenium	76.42±7.77 (64-98)	72.66±5.24 (61.72-83.2)	74.49±4.43 (65-85)	11.701	**<0.001***	P1**<0.001*** P2=0.116 P3=0.112

F=Oneway- ANOVA test
P1=control group vs acquired hypothyroidism group
P2= control group vs congenital hypothyroidism group
P3= acquired hypothyroidism group vs congenital hypothyroidism group

Table (3): clinical manifestations and history of the studied groups:

Variable			Control Group (n=90)	acquired group (n=177)	congenital group (n=33)	Test	
						x^2	P value
Family history of hypothyroidism	**Positive**	**No**	11	59	14	17.016	**<0.001***
		(%)	12.2%	33.3%	42.4%		
	Negative	**No**	79	118	19		
		(%)	87.8%	66.7%	57.6%		
Hair loss	**No**	**No**	88	101	22	47.641	**<0.001***
		(%)	97.8%	57.1%	66.7%		
	Yes	**No**	2	76	11		
		(%)	2.2%	42.9%	33.3%		
Constipation	**Yes**	**No**	7	17	10	13.476	**0.001***
		(%)	7.8%	9.6%	30.3%		
	No	**No**	83	160	23		
		(%)	92.2%	90.4%	69.7%		
T4 level	**Normal**	**No**	90	100	20	66.426	**<0.001***
		(%)	100.0%	56.5%	60.6%		
	low	**No**	0	77	13		
		(%)	0.0%	43.5%	39.3%		

TSH level	**Normal**	**No**	90	38	15	192.172	**<0.001***
		(%)	100.0%	21.5%	45.5%		
	Elevated	**No**	0	139	18		
		(%)	0.0%	78.5%	54.6%		
Zn level	**Low**	**No**	7	35	12	14.289	**0.001***
		(%)	7.8%	19.8%	36.4%		
	Normal	**No**	83	142	21		
		(%)	92.2%	80.2%	63.6%		
Se level	**Low**	**No**	16	54	7	5.454	0.065
		(%)	17.8%	30.5%	21.2%		
	Normal	**No**	74	123	26		
		(%)	82.2%	69.5%	78.8%		
ATP level	**Normal**	**No**	90	107	15	56.387	**<0.001***
		(%)	100.0%	60.5%	45.5%		
	Elevated	**No**	0	70	18		
		(%)	0.0%	39.5%	54.5%		
ATG level	**Normal**	**No**	90	159	33	13.307	**0.001***
		(%)	100.0%	89.8%	100.0%		
	Elevated	**No**	0	0	18		
		(%)	0.0%	0.0%	10.2%		

x^2 =Chi-Square Tests

Table (4): Basic characteristics of subclinical and clinical hypothyroidism groups:

Variable			**subclinical hypothyroidism group (n=81)**	**Clinical hypothyroidism group (n=96)**	**Tests**	
					t	**P value**
Age (years) Mean±SD Range			7.37±2.22 (5-14)	7.85±2.51 (5-16)	1.34	0.108
Weight (kg) Mean ±SD Range			31.1±9.04 (17-56)	33.47±10.93 (20-56)	1.5	0.122
Height Cm Mean±SD Range			112.46±8.76 (95-135)	113.8±10.17 (95-140)	0.933	0.352
BMI Mean±SD Range			24.18±4.43 (14.52-38.89)	25.37±5.27 (15.09-38.89)	1.6	0.109
Sex	**Male**	**No**	43	68	5.9	0.015*
		(%)	53.1%	70.8%		
	Female	**No**	38	28		
		(%)	46.9%	29.2%		

t= Independent Samples Test, x^2 =Chi-Square Test

Table (5): clinical characteristics and history of subclinical and clinical hypothyroidism groups:

Variable			subclinical group (n=81)	Clinical group (n=96)	Tests	
					t	P value
Thyroid function Mean ±SD Range	**T4 (ng/dl)**		1.35±0.29 (0.49-1.7)	0.62±0.41 (0.2-1.6)	13.4	<0.001*
	TSH (mIU/L)		9.78±8.45 (6.12-80)	25.34±24.85 (6.12-150)	5.37	**<0.001***
Thyroid antibodies Mean ±SD Range	**ATP**		31.37±12.22 (15-70)	37.42±14.39 (15-70)	2.98	**<0.001***
	ATG		28.62±5.31 (21-41)	31.56±6.55 (21-41)	2.34	**<0.001***
Trace elements Mean ±SD Range	**Zinc**		1.04±0.42 (0.42-2.01)	0.94±0.29 (0.42-2.01)	1.89	0.054
	Selenium		72.42±5.58 (61.72-83.2)	72.77±4.94 (61.72-83.2)	0.44	0.702
Family history of hypothyroidism	**Positive**	**No**	7	51	39.4	<0.001*
		(%)	8.6%	53.1%		
	Negative	**No**	74	45		
		(%)	91.4%	46.9%		
Hair loss	**No**	**No**	41	60	2.53	0.112
		(%)	50.6%	62.5%		
	Yes	**No**	40	36		
		(%)	49.4%	37.5%		
Constipation	**Yes**	**No**	8	9	0.13	0.910
		(%)	9.9%	9.4%		
	No	**No**	73	87		
		(%)	90.1%	90.6%		
T4 level	**Normal**	**No**	81	19	117	**<0.001***
		(%)	100.0%	19.8%		
	low	**No**	0	77		
		(%)	0.0%	80.2%		
TSH level	**Normal**	**No**	16	21	10.4	**0.005***
		(%)	19.8%	21.9%		
	High	**No**	65	75		
		(%)	80.2%	78.1%		
Zn level	**Low**	**No**	15	20	0.148	0.7
		(%)	18.5%	20.8%		
	Normal	**No**	66	76		
		(%)	81.5%	79.2%		
Se level	**Low**	**No**	23	32	0.5	0.479
		(%)	28.4%	33.3%		
	Normal	**No**	58	64		
		(%)	71.6%	66.7%		
ATP level	**Normal**	**No**	64	43	21.5	<0.001*
		(%)	79.0%	44.8%		
	Elevated	**No**	17	53		
		(%)	21.0%	55.2%		
ATG level	**Normal**	**No**	77	82	4.47	0.034*
		(%)	95.1%	85.4%		
	Elevated	**No**	4	14		
		(%)	4.9%	14.6%		

t= Independent Samples Test, x^2 =Chi-Square Test

Table (6): comparing hair loss and constipation in relation to zinc and Selenium level within the studied group

Variables	Hair loss		T	P value
	No (n=123)	Yes (n=87)		
Zn Mean ±SD	1.10±0.36	0.93±0.38	1.903	**0.04***
Se Mean ±SD	73.32±5.20	72.43±5.07	1.231	0.220
Variables	**Constipation**		**t**	**P value**
	Yes (n=27)	**No** (n=183)		
Zn Mean ±SD	0.91±0.39	0.98±0.36	-0.955	0.341
Se Mean ±SD	72.59±5.19	73±5.16	-0.384	0.701

t= **Independent Samples Test**

Table (7): Correlation between Zinc, selenium, T4 and different parameters

Variables		Zn	Se	T4 (ng/dl)
Zn	r	1	**.219****	**.259****
	p		**.001**	**.000**
Se	r	**.219****	1	.020
	p	**.001**		.769
T4 (ng/dl)	r	**.259****	.020	1
	p	**.000**	.769	
TSH (mIU/L)	r	**-.274****	**-.160***	**-.466****
	p	**.000**	**.020**	**.000**
ATP	r	.021	-.044	**-.259****
	p	.765	.524	**.000**
ATG	r	.092	.019	**-.229****
	p	.182	.790	**.001**
weight	r	-.081	-.028	**-.159***
	p	.242	.687	**.021**

r= Pearson Correlation, p= Sig. (2-tailed)

DISCUSSION

Being the second most frequent endocrine illness in children globally after diabetes, thyroid disorders make up a significant share of pediatric endocrine disorders. During infancy and youth, thyroid dysfunction impacts growth and development in addition to causing metabolic problems. When hypothyroidism in a fetus or newborn goes untreated, it causes lifelong problems in intellectual and/or neurological function. When hypothyroidism in an adult goes beyond the age of three, it causes poor growth and delayed skeletal maturity. **[7].**

The thyroid gland is rich in selenium, which binds to a variety of selenoproteins to shield the gland from the excess hydrogen peroxide produced during the production of thyroid hormones. Thyroid metabolism diseases may exhibit anomalies due to low selenium availability. It is essential for the immune system to operate properly and plays a significant role in thyroid hormone metabolism **[3].**

The trace element zinc is involved in the body's metabolic processes and cell division. Furthermore, it is thought that the thyroid plays a significant part in zinc hemostasis. The idea that zinc-binding protein is present in the nuclear T3 receptor underlies the connection between zinc and thyroid metabolism. Thyroid hormones therefore impact the uptake and excretion of zinc **[6].**

Our study showed that, the mean age (years) of the cases group was 6.33±2.65 years with median 6 (5-9), the mean weight was 27.71±11.79 with median 27 (18-30) and the mean weight SD was 0.98±0.98 with median 1.34 (0-1.34). More than half of cases (58%) were males, (36%) of the studied group showed positive family history and more than half (56.7%) complained of hair loss.

In agreement with, **Oyenusi et al. [7]** who found that thyroid diseases were 1.7 times more common in males, they observed that there was a little female majority in the patients seen in the index study.

This agreed with **Khorasani et al. [8]** who aimed to evaluate the selenium status of children with hypothyroidism and ascertain its correlation with the metabolism of thyroid hormones. They stated that 23 kids with hypothyroidism were included in the trial. Fourteen (60.9%) of these were male. The age ranged from 1 to 72 months, with a mean of 30 months (±25.09).

In the present study, mean zinc value was (0.98±0.36), the mean value of selenium was (73.5±5.16) in thyroid disorders patients with hair loss while in thyroid disorders patient without hair loss, mean zinc value was (0.91±0.39) and the mean selenium value was (72.59±5.19) with no significant difference.

Studies have indicated that among Iranian children aged 1-16 who are in good health, the average plasma selenium level is 84.2 ± 11.36 ng/dl. **[9].** According to a study by **Mahyar et al. [10],** healthy Iranian children had the lowest serum selenium levels. The study conducted by **Amiri et al. [11]** in **Khoshdel et al. [12]** from Shahrekord, Iran, had the highest serum selenium levels. Variations in research findings may be attributed to variations in the kind of nourishment and geographic location, as well as other variables including age, gender, food habits, and selenium levels in various regions. Elevations of free radicals, alterations in enzyme function, and ultimately neurological problems are other reasons that might impact selenium levels **[13].**

This study showed that, about (45%) of cases showed low T4 level, more than half of cases (54.2%) had manifest hypothyroidism and (45.8%) were subclinical hypothyroidism. About (44%) of cases had elevated ATP levels and (10.2%) of cases had elevated ATG levels.

The results of **Cvijanovich et al. [14],** who examined 20 critically sick patients and discovered low plasma zinc levels, and **Linko et al. [15],** who reported low serum zinc in 95.8% of critically ill patients, are also noteworthy. As stated by **Moravej et al. [16],** who sought to assess the significance of selenium insufficiency in children and teenagers who had developed acquired hypothyroidism. Not only was iodine low, but also deficiencies were discovered in selenium, zinc, and molybdenum. **Turan and Turksoy [17]** stated that the low serum levels of zinc and selenium in the nodular goiter group were the study's primary finding. Together with iodine, selenium is a crucial thyroid gland trace element. Thyroid dysfunction and structural alterations in the thyroid gland may result from abnormal iodine and selenium consumption. In Turkey, salt iodization has been required since 1998 as a public health measure due to a moderate iodine deficiency **[18].**

As shown in our results, there was statistically significant difference between the sub clinical hypothyroidism and clinical hypothyroidism as regard zinc grade where clinical hypothyroidism shows more cases (33.3%) of low levels of zinc. Also there was statistically significant difference between the sub clinical hypothyroidism and clinical hypothyroidism as regard selenium grade where clinical hypothyroidism shows more cases (36.6%) of low levels of selenium.

Kawai et al. [19] have provided an explanation of how thyroid function is affected by selenium insufficiency. Additionally, a different Iraqi investigation found that the hypothyroidism patients' plasma selenium levels were noticeably lower than those of the healthy samples. **Al-Juboori & Associates [20]** Conversely**, Jang et al. [21],** who assessed patients with hypothyroidism in Korea, discovered that selenium insufficiency is not a typical outcome for these individuals.

Iran has also been the site of some research. According to **Nazemi et al. [22],** there was little selenium in the soil and water in many parts of our nation. Additionally, a different study demonstrated that giving selenium to women with hypothyroidism improves thyroid function. **[23].** But study by **Nourbakhsh et al. [24]** showed that children and adolescents with hypothyroidism and those in good health had the same levels of selenium and selenioprotein. Different findings about the involvement of selenium in thyroid problems have been reported by Iranian researchers; this could be explained by the

diversity of geographical and environmental factors.

Epidemiological studies indicated the correlation between elevated thyroid volume, thyroid nodules, and overall risk of various thyroid diseases and mild selenium deficiency **[25, 26].**

The results of the current investigation demonstrated a strong negative association between TSH, zinc, and selenium levels. Age and weight had a substantial positive association. A substantial positive association was seen between the levels of ATP and ATG.

This was in line with the findings of **Gustin et al. [27]** who evaluated the combined relationships between plasma concentrations of thyroid hormones and thyroid-stimulating hormones (TSH) in pregnancy and the status of iodine, selenium, and zinc. According to their findings, zinc had a positive correlation with all the plasma concentrations of fT4, tT4, fT3, and TSH in the BKMR analyses.

First-trimester plasma zinc was positively correlated with contemporaneous fT4 in a large (n = 2041) Dutch study **[28],** but not with TSH, which is repressed in the early stages of pregnancy **[29].** Maternal plasma selenium (59–103 μg/L) late in the first trimester was favorably correlated with TSH and negatively correlated with fT4 **[28]** in the previously stated Dutch investigation; T3 was not tested.

Turan and Turksoy [17] showed that elevated TSH levels and/or thyroid volume can result from iodine insufficiency and severe selenium deficit. Low serum selenium concentration was linked to an increased risk of thyroid nodules and an enlarged thyroid gland in Denmark, according to **Rasmussen et al. [25].** Patients with low serum selenium did not have an increased incidence of thyroid nodules, according to study by **[30].**

CONCLUSION

Selenium and zinc deficiency was found in children who were found to have dysfunctional thyroid disorders.

CONFLICTS OF INTEREST

The authors report no conflicts of interest. The authors along are responsible for the content and writing of the paper.

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