

Research Article

Selenium level in a sample of thyrotoxic Egyptian patients



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Abstract

Background: Selenium is an essential trace mineral that supports many body processes. It can help improve cognition, immune system function, and fertility and plays a key role in maintaining thyroid hormone metabolism and DNA synthesis and protecting the body from oxidative damage and infection. The aim is to detect selenium level in a sample of thyrotoxic Egyptian patients and to detect whether it's level is affected in thyrotoxic Egyptian patients with and without thyroid eye disease. **Methods:** This prospective case-controlled-hospital-based study was carried out in outpatient clinic of internal medicine department faculty of medicine Minia university from August 2021 to June 2022. the study included 50 subject divided into 2 groups: group1 which involved 35 Egyptian thyrotoxic patients (20 females and 15 males), group2 Consisted of 15 apparently healthy subjects (10 females and 5 males). patients were excluded if any of them were critically ill other thyroid diseases rather than thyrotoxicosis -any patient who was critically ill or recently admitted to ICU, all included patients were subjected to history taking, clinical examination, laboratory investigation in the form of TSH, FT3, FT4, Selenium level and selenium by ELISA. **Results:** the study demonstrated a predominant female gender and serum selenium level was significant low in this sample of thyrotoxic Egyptian patients with and without eye disease as compared to control group. **Conclusion:** Serum selenium levels was low in this sample of Egyptian thyrotoxic patients and may has a role in thyroid eye disease.

Key words: thyroid, eye disease, selenium.

Introduction

Thyrotoxicosis is the clinical manifestation of a group of disorders characterized by the presence of excess thyroid hormone action at the tissue level⁽¹⁾. The prevalence of hyperthyroid-dism is 1.3% in-the United States. It occurs more commonly in women compared with men (2% vs 0.2%), and the incidence increases with age, iodine deficiency, and race⁽¹⁾

Thyroid eye disease (TED) is a manifestation of autoimmune thyroid

disease that can lead to significant functional impairment and cosmetic disfigurement.⁽²⁾ TED occurs in up to 50% of patients with Graves' disease, and up to 6% of these patients may go on to develop severe sight-threatening complications, such as compressive optic neuropathy. The onset of TED typically coincides with the onset of hyperthyroid-dism, but ocular manifestations may be preceded by, or followed by, the elevation of thyroid hormone levels Although most commonly associated with Graves disease, TED can

also be seen in autoimmune hypothyroidism and in euthyroid patients with no prior history of thyroid dysfunction⁽²⁾

Although the exact pathophysiology is still incompletely understood, studies have shown that the increased production of glycosamino glycans as well as lymphocyte and macrophage infiltration of orbital tissues result in the disfiguring edematous and fibrotic changes seen in TED⁽²⁾.

Selenium is an essential trace mineral that supports many body processes, it can help improve cognition, immune system function, and fertility and plays a key role in maintaining thyroid hormone metabolism and DNA synthesis and protecting the body from oxidative damage and infection.⁽³⁾ Selenium is most often found in whole grains and animal products such as fish and eggs. The amount of selenium in grains and grain-based foods depends on the soil content where they grew⁽⁴⁾

The thyroid contains the highest concentration of selenium in the human body and is able to retain it even under conditions of severe deficiency. A number of selenoproteins are expressed in thyrocytes those named later being particularly important to thyroid function⁽⁵⁾

Patients and Methods

This prospective case-controlled-hospital-based study was carried out in outpatient clinic of internal medicine department, faculty of medicine, Minia University. study was approved by Ethics Committee of the Faculty of Medicine, Minia University. Informed consent was obtained from all participants. This study was conducted on 50 patients divided into 2 groups: **group 1** involved 35 thyrotoxic Egyptian patients attending to the clinic including 20 females and 15 males. Their ages from 22 years to 66 years. **Group 2** Consisted of 15 apparently healthy subjects Including 10 females and 5 males their age from 22 years to 63years. Patients were excluded if any of them were critically ill or recently admitted to ICU. all included patients were subjected to history taking,

clinical examination, laboratory investigation included (TSH, FT3, FT4, and serum Selenium level by ELISA).

It was determined using (Chemiluminescence Cobas e411 analyzer, HITACHI, Germany). Assessment of serum selenium: kits were supplied by ABC Egypt kits Normal level of serum selenium is 70:150 ng/ml.

Whole blood samples were collected by venipuncture, taken care to avoid hemolysis, under complete aseptic conditions in sterile tubes and containers 3 ml of blood was withdrawn from all study subjects for assessment of serum selenium level.

Ethical consideration:

The study was approved by Ethics Committee of the Faculty of Medicine, Minia University. Informed consent was obtained from all participants. The steps, the aims, the potential benefits and hazards, all were discussed with the patients.

Statistical analysis:

The analysis of the data was carried out using the IBM SPSS 26.0 statistical package software (IBM; Armonk, New York, USA). The normality of the data was tested using the Shapiro-Wilk tests. Data were expressed as mean, and standard deviation for quantitative measures, in addition to both number and percentage for categorized data. Mann-Whitney U test for non-parametric data were used for comparison between two independent group, Kruskal-Wallis Test for comparison of more than two groups. The Chi-square test or Fisher's exact test was used to comparing categorical variables. A p-value less than 0.05 was considered significant.

Results

The present study included 50 subjects divided into two groups: in group 1 females were 57.1% while in group 2 females were 47.7% and it was no significant difference was found among the two groups (p=0.804). As regarding age in group 1 their ages was from 22 to 66 years, in group 2 their ages were from 22 to 63 years and

this was statistically insignificant. ($p=0.294$). (As shown in table 1).

In table 2 it was found that TSH level was significantly lower in group 1 compared to its level in group 2 ($p=0.001$). FT3 and FT4 in group 1 was significantly higher compared to group 2 ($P .001$). serum

Selenium level in group 1 was significantly lower compared to group 2 as it ranged from 39 to 60 ng/ml in Egyptian thyrotoxic patients compared to its higher level in group 2 as it ranged from 72 to 90ng/ml ($P .001$). TED was present only in 2.9% of group 2.

Table (1): demographic data of study groups

Demographic data	Groups		P value
	Cases (No= 35)	Control (No = 15)	
Age (years) [¶]	22-66 37 ± 11	22-63 39.06 ± 10	0.2
Weight (kg) [¶]	43-75 61.62 ± 7.52	35-73 57.4 ± 11.2	0.2
Sex [¥]			0.8
Males	15 (42.9%)	7 (46.7%)	
Females	20 (57.1%)	8 (53.3%)	
Comorbidities [¥]			
Diabetes Mellitus	3 (8.6%)	0 (0%)	0.2
Hypertension	4 (11.4%)	0 (0%)	0.1
Atrial fibrillation	0 (0%)	0 (0%)	---

[¶]Data presented as range and mean±SD, [¥]Data presented as number (%)

Table (2): thyroid function and serum selenium level in study groups

thyroid function and serum selenium level	Groups		P value
	Cases (No= 35)	Control (No = 15)	
TSH	0 - 1.5 (0.19 ± 0.47)	0.6 - 4.6 (2.62 ± 1.28)	< 0.001*
Free T3	1.6 – 185 (22.38 ± 31.5)	2 - 3.8 (2.88 ± 0.59)	< 0.001*
Free T4	1.2 – 95 (12.24 ± 21.2)	0.5 - 3.5 (0.96 ± 0.71)	<0.001*
Selenium	39 – 60 (48.05 ± 7.09)	72 – 90 (84 ± 6.35)	< 0.001*

Discussion

The current study demonstrated a predominant female gender as they were 57.1% (20) versus males as they were 42.9% (15). This is consistent with Palikhe et al.,⁽⁶⁾ who studied 117 thyrotoxic patients and found that 68.3% were females and 31.6% were males, and found that females were more commonly affected⁽⁶⁾ This matched ⁽⁷⁾ study on 200 cases of thyrotoxicosis with

primary and secondary types the study population was 60% (120) females and 40% (80) males and this belongs to thyrotoxicosis more common in females⁽⁷⁾. It is documented that women have a higher reported incidence of Graves' disease than men, with a female to male incidence ratio of approximately 7:1 to 10:1⁽⁸⁾.

According to the American Thyroid

Association (ATA) It is not scientifically known why women are so vulnerable to thyrotoxicosis, though it is suspected that the development of thyrotoxicosis is linked to autoimmunity which is more commonly found in women than men. Another reason is that there is an interplay between thyroid hormones and the hormones that fluctuate during the menstrual cycle. Thyroid problems can happen at any time but they are especially common in women during and after menopause when hormone levels are changing. Some women may confuse the symptoms of thyroid disorders with the effects of the menopause, which can prevent them from seeking treatment⁽⁹⁾.

In the present study Egyptian thyrotoxic patients ages were ranged from 22 to 66 years. This is in consistent with⁽⁶⁾ the age of presentation of thyrotoxic patients was ranged from 17 to 65 years⁽⁶⁾. Also Essayed, 2013 found that the age of thyrotoxic patients was ranged from 18 to 59 years⁽⁷⁾. The peak age-specific incidence of Graves' disease was between 20 and 49 years⁽¹⁰⁾.

The Present study didn't demonstrate a significant eye manifestation in thyrotoxic patients as it was present in only 2.9%. Hyperthyroidism patients had greater chance of ocular manifestation with 33.3% (23 patients) manifested by exophthalmo⁽⁶⁾. Approximately 5% of the patients with Graves' disease develop moderate to severe GO, with a similar risk in women and men with Graves' disease⁽¹¹⁾. The risk of GO is much higher in patients aged 40-60 yr than in young patients with Graves' disease. Salt iodization was not associated with a change in the incidence of GO⁽¹¹⁾. Thyroid orbitopathy is a relatively rare disease⁽¹²⁾

Based on Best Pract Res Clin Endocrinol Metab. The incidence of Graves' orbitopathy (GO) is 16/100,000 in females and 2.9/100,000 in males as studied in Olmsted County. It can be calculated that the approximate prevalence is 0.25%. There is a gender bimodal distribution. Go usually occurs at the time of onset of the

hyperthyroidism but may present up to a year before that time or as long as 5 years afterward. Around 10-15% of patients have never been hyperthyroid and some are hypothyroid at GO presentation. Although the incidence of GO has probably been decreasing during the last 2 decades definite figures for this assertion are not available. Risk factors that may influence the incidence of GO include cigarette smoking and radioiodine treatment of hyperthyroidism. There are also complex genetic factors with multiple susceptibility alleles that contribute to the expression of the disease. The probability is that a reduction of the incidence of GO will be achieved by influencing the environmental factors⁽¹³⁾.

The present study demonstrate low selenium level in thyrotoxic patient while normal or slightly low in controlled group as in the present study selenium in thyrotoxic group ranged from 39 to 60ng/ml while in controlled group it ranged from 72 to 90 ng/ml this difference was statistically significant (P .001). In agreement with⁽¹⁴⁾ who found that serum selenium levels were significantly lower in Graves patients with or without GO, compared to non-Graves control participants⁽¹⁴⁾. Selenium levels in GO were lower than in healthy control participants but did not demonstrate an association between selenium levels and GO severity⁽¹⁵⁾. Moreover, serum selenium was lower in patients with GO than in those without GO and suggested that selenium deficiency could be a risk factor for clinical manifestation of GO in GD patients⁽¹⁶⁾.

Jwu Jin Khong et al.,⁽¹⁶⁾ have studied 198 patients with Graves' disease participated in the study: 101 with Graves' orbitopathy and 97 without Graves' orbitopathy Serum selenium levels in both groups were measured. It was found that Serum selenium levels were lower in patients with GO compared with GD in an Australian study population with marginal selenium status. Relative selenium deficiency may be an independent risk factor for orbitopathy in patients with Graves' disease⁽¹⁶⁾

The thyroid contains the highest concentration of selenium in the human body and is able to retain it even under conditions of severe deficiency. A number of selenoproteins are expressed in thyrocytes those named later being particularly important to thyroid function. The deiodinases. DIO1 and DIO2 can activate T4 by transforming it into T3 by removal of the 5'-iodine, while DIO1 and DIO3 can prevent T4 from being activated by converting it to the inactive reverse T3. DIO3 can also inactivate T3 by 5-deiodination to diiodothyronine. DIO2 is largely responsible for the local conversion of T4 to T3 in extrathyroidal target tissues. A major role of DIO3 is to protect sensitive cells, such as fetal tissue, the placenta and central nervous system, from excessive concentrations of the active hormone, T3. The glutathione peroxidases. Extracellular glutathione peroxidase (GPX)3 is the only actively secreted GPX isozyme that is abundantly expressed in the thyroid gland. It is secreted at the apical side of the thyrocyte membrane where it converts excess hydrogen peroxide that has not been used by TPO for the iodination of tyrosyl residues of Tg or for iodotyrosine coupling, into harmless water⁽⁵⁾.

Conclusions:

Serum selenium levels were significantly lower in thyrotoxic patients with and without exophthalmos, compared to non-thyrotoxic control participants.

Ethical considerations:

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Conflict of interest: None.

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