Effect of selenomethionine- enriched yeast on Hypothyroidism patients

Abstract

The trace mineral selenium (Se) is one of the most critical micronutrients, significantly affecting public health. It is a vital component in numerous enzymes and proteins called selenoproteins; hence, Se plays a crucial role in the range of biological activities. Hashimoto's disease is the most common cause of hypothyroidism. In addition to Selenium being a critical micronutrient for thyroid health, there is a direct association between Selenium and liver health. This study aims to examine the effect of Selenium on lipid factors, thyroid factors (anti-TPO and TSH), and liver enzymes. A double-blinded, randomized clinical trial was conducted by enrolling 40 patients with Hashimoto's thyroiditis in two equal control (placebo) and intervention (Selenium) groups. Two hundred micrograms of Selenium were admitted to participants for 60 days. Blood samples were obtained before and after the intervention. Total blood catalase, anti-TPO, TSH, malondialdehyde, serum lipid profile, and liver factors were measured by spectrophotometric method, and the results were analyzed. Plasma MDA levels decreased significantly under the influence of selenium consumption, and hemoglobin levels in the experimental group significantly increased after the intervention ($P < 0.05$). Catalase enzyme, lipid profile components, and liver enzymes in the intervention group did not change significantly compared to pre-intervention and the control group ($P > 0.05$). TSH and anti-TPO levels indicated a relative decrease in the intervention group($P > 0.05$). According to our findings, Selenium consumption in Hashimoto's thyroiditis was associated with improved serum lipid factors, liver enzymes, anti-thyroid peroxidase antibody, MDA, and HGB levels.

Keywords: Hashimoto's disease, Selenium, lipid factors, liver enzymes, thyroid factors.

1.Introduction:

The trace mineral selenium (Se) is one of the most critical micronutrients significantly affecting public health (1, 2). It is a vital component in numerous enzymes and proteins, called selenoproteins; hence, Se plays a crucial role in the range of biological activities, including anti-inflammation, thyroids, fertility, DNA synthesis, as well as reproduction(3, 4). Selenium is also known for its potent antioxidant function (5, 6).

Based on reports, many people have insufficient nutritive consumption of Se because of short soil bioavailability and low concentrations of Se in vegetables (7). One of the most common techniques to raise the content of Se in food products is via the enrichment of foods with the organic form of Se. In this respect, live yeast cells can absorb Se and transform it into L(+) selenomethionine (8). Considering it is toxic in an inorganic form in high consumption doses at a milligram (mg) level (9). The abnormal levels of Serum liver enzymes are frequently reported in hypothyroid patients (10). There is a complex association between thyroid and liver health. The activation of thyroid hormones is nearly dependent on the Liver role (10). Based on reports, an average level of Se is required to avoid thyroid disorders. In this respect, a high risk of thyroid cancer has been reported under Se deficiency (11, 12)

Studies show a direct relationship between Se levels in serum with low-density lipoprotein (LDL) cholesterol, triglycerides, and total cholesterol concentrations in populations with high Se levels (13, 14).

In this study, we examined the effects of Se on liver enzymes, lipid factors, HGB, MDA, total antioxidant, and Glutathione reductase levels under a double-blinded clinical trial performed on Hashimoto's patients.

2.Materials and Methods

2.1. Study population

A prospective randomized, double-blind, placebo-controlled clinical trial was carried out on 40 patients with subclinical hypothyroidism symptoms aged 18–60. The study was conducted from July 2019 to October 2019 in the outpatient ward of the Endocrine Clinic, Emam Reza Hospital, Tabriz City. Patients were enrolled in this study after written consent and a brief description of the study's importance to them.

Diagnoses were made based on TSH levels in two consecutive tests and examined by an expert endocrinologist. The patients were classified into two groups (control and intervention). The patients who consumed trace element and antioxidant supplements in the previous six months, suffered from renal failure, proteinuria, acute and chronic liver disease, were pregnant women and had heart problems were removed from this study.

2.2. Sample size

The sample size was calculated based on a pilot study (TSH changes as the primary outcome were calculated before and after intervention for five samples per group).

The sample size was calculated to be 20 for each group using a standard formula for randomized controlled trial based on the first type error (α) of 0.05 and 80% power anticipating an approximate drop-out rate of 10% during the study; thus, 20 participants were enrolled in each group.

2.3. Trial procedure

Forty patients based on TSH levels were randomly allocated to one of the groups (control and treatment) using a randomized block method in which both participants and investigators were blinded to allocations. The participants' data, including age, gender, weight, and height, were recorded before starting the study. The height and weight of participants were measured without shoes and with minimum clothes via a calibrated scale and stadiometer. BMI was calculated as weight (kg)/height (m2).

The individuals in the treatment group received 200 µg selenium capsule (Se-enriched yeast) once a day, and the control group also received a placebo capsule for eight weeks. Se-enriched yeast was generated at the Nutrition Research Center, Tabriz University of Medical Sciences, Iran, via growing *Saccharomyces cerevisiae* in Se-rich media (15, 16). During the study, the participants maintained their usual physical activity, dietary, and medication intake. The effects of Se consumption were monitored weakly in participants.

2.4. Metabolic parameters

From each participation, 5 ml venous blood samples were obtained before and after Se supplementation consumption. TSH (normal range: 5.0 milli-international units per liter (mIU/L)), anti –TPO (normal range: less than 34 international units per millimeter (IU/ml)), total blood catalase, Malondialdehyde (MDA), Serum cholesterol level, liver enzymes (ALT and AST), Glutathione reductase (GR), Total antioxidant capacity (TAC) were measured by commercial methods. The blood MDA, TCA, HGB, and GR were measured using the spectrophotometric method. Serum total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), ALT, and AST were measured via an auto analyzer.

2.5. Statistical analysis

Descriptive parameters were obtained for all the study variables in each study group. The Kolmogorov-Smirnov test was used to evaluate the variables' normality.

3. Results

This study randomly classified patients into two groups: the intervention group (mean age: 39.36 ±2.41) and the control group (mean age: 45.38±3.29). The levels of TSH and Anti -

TPO were examined in two groups. Results indicated a relative decrease in TSH and Anti - TPO levels, but no significant difference exists between the intervention and placebo groups at the baseline and after treatment. The mean GR, TAC, ALT, AST, total cholesterol, HDL-C, LDL-C, VLDL, TG, MDA, and HGB levels were also examined in the two groups at the baseline and after treatment and displayed in (Table 1).

Table1: Mean (standard deviation) level of metabolic factors under treatment of selenium for 60 days.

Variables	Before Se Treatment	After Se Treatment	Before Placebo Treatment	After Placebo Treatment	*P. value in treatment group*	*p.value in placebo group*
GR	13.1±0.1	13.19±0.15	13.05±0.09	13.04±0.08	0.752	0.912
TAC	1.52±0.03	1.64±0.02	1.59±0.02	1.67±0.07	0.06	0.273
ALT	35.36±0.64	33.93± 0.67	35.54±0.31	35.78±0.42	0.804	0.533
AST	34.6±1.13	33.07±0.82	34.31±0.48	34.14±0.58	0.816	0.823
CAT	69.64±11.82	122.91±11.95	92.15±6.57	83.07±10.88	0.62	0.462
HGB	13.64±0.37	13.82±0.2	13.57±0.33	13.46±0.26	**0.038**	0.798
MDA	1.97±0.18	1.09±0.01	1.75±0.08	1.1±0.01	**0.049**	0.794
Total cholesterol	190.8±9.1	180.6±12.67	197.8±8.08	210.5±14.3	0.347	0.468
HDL-C	23.83±2.19	21.56±1.89	28.17±1.68	25.97±1.82	0.544	0.339
LDL-C	128.95±5.1	123.34±5.38	140.02±8.79	152.32±13.8	0.916	0.462
V-LDL	31.38±4.88	28.2±4.33	28.84±4.68	32±4.24	0.229	0.623
TG	156.9±24.41	141.4±21.94	144.2±23.41	160±21.2	0.952	0.633
TSH	8.31±4.2	7.7±2.32	8.09±0.93	6.56±1.18	0.467	0.269

Anti-TPO	457.06±139.26	396.82±142.16	483.49±144.06	521.79±128.84	0.399	0.395

Based on the results, catalase level was increased in the intervention group during 60 days' treatment with Se capsules. The HDL, LDL, TG, total cholesterol, and VLDL values were insignificantly reduced during treatment with Se capsules. The within-group comparison indicated that the mean MDA level reduced (*P = 0.004*), and the mean HGB significantly increased after the treatment with Se supplement (*P = 0.038*) in the intervention group. Based on the results, variation in MDA(*p*=0.794) and HGB(*p*=0.798) levels in the placebo group were not statistically significant. Based on the results, none of the metabolic factors were under the effect of demographic factors, except HDL and HGB levels, which were significantly dependent on gender(*p=0.074*) and BMI(*p=0.019*), respectively (Table 2).

Table2: The effect of demographic factors on metabolic parameters levels

Variables	**Gender**	**Age**	**Waist**	**Height**	**Weight**	**BMI**
HDL-C	**0.074**	0.919	0.756	0.254	0.426	0.351
VLDL	0.134	0.526	0.958	0.338	0.474	0.46
LDL-C	0.9	0.927	0.647	0.351	0.322	0.328
TG	0.134	0.526	0.958	0.338	0.474	0.46
Total cholestrol	0.443	0.435	0.567	0.384	0.268	0.269
MDA	0.109	0.843	0.676	0.238	0.439	0.371
HGB(g/dL)	0.233	0.777	0.373	**0.011**	**0.021**	**0.019**
Catalase	0.887	0.968	0.556	0.664	0.702	0.692
GR	0.826	0.451	0.252	0.324	0.3	0.315
TAC	0.183	0.13	0.354	0.684	0.815	0.809
ALT	0.566	0.838	0.621	0.295	0.328	0.286

AST	0.887	0.474	0.157	0.417	0.517	0.504

4. Discussion

Considering the increasing prevalence of thyroid disease and the high side effects of thyroid disorders on public health, it is essential to introduce control and prevention strategies because of (17). For instance, there is a direct relationship between thyroid diseases and liver disorders (18). This study examined the effect of selenium as a confirmed dietary supplement on thyroid hormones, liver enzymes, and lipid factors.

Based on our findings, lipid factors (TGD, VLDL, LDL, HDL, and total cholesterol) were relatively decreased in the selenium group, but the differences between the two groups were insignificant. Based on our findings, selenium has no notable effects on plasma lipid profiles, although it has modified lipid factor values compared with the placebo group. These results are consistent with a recent meta-analysis study about a marginal effect on reducing TG levels and the lack of effect on total cholesterol and HDL-C levels (19).

However, the reduction of MDA level was significantly dependent on selenium ($P<0.05$), as well GR, CAT, and TAC enzymes indicated a slight increase compared with the placebo group (20, 21). In this study, liver enzymes, including ALT and AST, were also evaluated, indicating a relative reduction compared to the placebo group consistent with similar studies (22, 23).

Our findings indicated a relative decrease in TSH and anti-TPO values; however, there was no significant difference between the two groups. These results are consistent with similar studies regarding the weak effect of selenium in patients with autoimmune hypothyroidism (24) and the lack of effect on TPO Ab levels in women with autoimmune hypothyroidism (25).

According to our findings, Selenium consumption in Hashimoto's thyroiditis was associated with improved serum lipid factors, liver enzymes, anti-thyroid peroxidase antibody, MDA, and HGB levels.

Our findings highlight the significant effect of selenium supplementation on serum MDA and HGB levels in subclinical hypothyroidism patients. Considering the confusing results related to the effect of selenium supplements on serum lipid factors and liver enzymes, further studies with larger sample sizes and different doses of selenium are suggested to reach more accurate results.

Declarations

Acknowledgments

This study was supported by the Nutrition Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.

Author contributions

A.H. and A.D. designed the study and performed the data analysis and interpretation; A.F. and M.M. revised the manuscript. A.O. wrote the first draft. B.K. discussed the results. The authors read and approved the final manuscript.

Funding

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have no conflict of interest.

Ethics approval and consent to participate

The study was conducted after ethical approval of the ethics committee of Tabriz University of medical science, Tabriz Iran (reference number: IR. TBZMED. REC.1398.339) and was registered on the website of Iranian Registry of Clinical Trials (IRCT20190212042686N2), available in https://www.irct.ir/.

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