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Original Article

Effect of Zinc Supplement and Weight Lifting Exercise on Thyroid Hormone Levels

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Abstract

The aim is to determine the effect of 6-week zinc supplement and weight lifting exercise on the thyroid hormone levels. Study participants were 40 males, age between 18-22 years; 20 sedentaries and 20 individuals who do physical exercises. Subjects were divided equally into 4 groups. Which is: The sedentary group (S) control group,Sedentary group which is supplied withonly zinc (Z+S),Training Group which is supplied with zinc (Z+T) andAthletes Group that train regularly (T). Zinc supplement was given 3mg/kg/day/6 weeks as oral. At the beginning of the study and after 6-week training, the blood samples were drawn from the participants before and after the treatments; and TSH, FT3 and FT4 levels of the participants were determined.

It was identified that thyroid values of groups which were supplied with zinc decreased owing to the training and zinc supplement.

Consequently, it is thought 6-week zinc supplement and exercise can contribute to the athletes' performance by changing thyroid values positively.

Introduction

A 70-kg human body contains approximately 2-3 grams of zinc which is the most abundant trace metal found in human body after iron; and most of it is located in intercellular areas (1). It has been ascertained that zinc is effective in organization of immune functions and neural transmission along with free radical production and protection against oxidative stress roles (2, 3). Furthermore, the zinc plays a vital role in several biological processes such as enzyme activity, cell membrane stabilization, gene expression and cell stimulation (4). Considering the performance, it is known that zinc deficiency causes the athletes to generate less power during activity (5).

Thyroid hormones are required for normal function of tissues. They have a big effect on oxygen consumption and metabolic rate (6). Thyroxine and triiodothyronine, the thyroid gland hormones, increase with severe exercises and that increase is associated

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with energy balance realization (7). Thus, as thyroid hormones affect the energy metabolism, lipid metabolism, protein synthesis and growth and have an synergic impact on the other hormones, the relation between physical activity and thyroid functions has been studied in several studies (8). It is known that zinc is in interaction with growth hormone, sex hormone, thyroid and prolactin (9). Wada and King (10) have demonstrated that there is a relation between zinc and thyroid hormone. Its effect may change with regard to the exercises. It is determined that as the type, intensity and period of exercise affect the TSH secretion (11), acute or regular exercise may cause changes in serum thyroid hormone levels (12). It is known that long-term heavy exercises increase the T3 and T4 levels (13). Accordingly, it has been confirmed the TSH, T3 and T4 hormone levels increase after marathon races (14). In another study, Sullo et al. (15) stated that swimming exercise generates increase in the serum TSH levels. Ciloglu et al. (16) have argued maximal aerobic exercises affect significantly the thyroid hormone levels. Moreover, the fact that doing exercises have short-term and long-terms impacts on zinc metabolism is also known (17). In consideration of these arguments, doing exercises brings about different changes in human body in terms of its content. Besides, it is believed that zinc which plays a significant role in many enzyme functions can have also vital impact on physical performance (18).

In this regard, it has been aimed to determine the effect of 6-week zinc supplement and weight training on the thyroid metabolism (TSH, FT3 and FT4) of the sedentaries and athletes.

Methods

Study groups

40 healthy male ranging in age from 18 to 22 participated in the study. The subjects were equally divided randomly into 4 groups. The pretest-posttest design was used in that study.The experiment conformed to the Declaration of Helsinki and was approved by the Institutional Ethics Committee of Adiyaman University.

1st Group: The Control (Sedentary) Group(S)

2nd Group: The Sedentary group which is supplied withonly zinc (Z+S),

3rd Group: Training Group which is supplied with zinc (Z+T)

4th Group: The Athletes Group that train regularly (T).

The second and third group was supplied with zinc as oral (3 mg/kg/day) in addition to the normal diet for 6 weeks. Furthermore, the third and fourth group did weight lifting for 90-120 minutes throughout 6 weeks. The first group which represented the control group (sedentary) did not take any supplements or do training.

Identification of the Subjects' Thyroid Hormones

At the beginning of the study, it was drawn blood samples of 2,5 cc with heparinized injectors from the rested subjects. After they were centrifuged, TSH, FT3 and FT4 levels were examined.

Examination of the Blood Samples

The blood samples were centrifuged at 3000 rpm[3] for 10 minutes and the blood plasma fractionation was done. The measurement of the plasma parameters was carried out at the Biochemistry laboratory of ÖzelIsilKardiyoloji DaliMerkezi (Private Isil Cardiology Center) which operates in Diyarbakir. The analysis of TSH, FT3 and FT4 levels were done through the Enzymatic Colometric method by using the scientific brand BT3000 biochemistry auto analyzer.

Statistical Analyses

The variance analysis was used to identify the differences between the values of the groups obtained through measurements; and the Duncan's Multiple Range Test was applied in order to determine the groups between which differences were ascertained. The comparison of the groups was made through t-test in order to determine the differences they show according to the measurements (19). The statistical

analyses were conducted via SPSS 16.0.

Results

When the bodyweight values given at Table I is examined, it has not been found any differences between the pre-test and post-test values of the 1st group ($p>0.05$). It is identified statistically significant differences between the pre-test and post-test values of the 2nd, 3rd and 4th groups. It has been determined that zinc supplementation and weight lifting exercise enables individuals to lose weight ($p<0.05$). It is observed differences between the groups when the weight loss of the groups is compared with the control group and other groups ($p<0.05$).

In Table II, TSH, FT3 and FT4 levels of the groups are given. When the post test TSH values are examined, it has been determined significant decreases in training and supplement groups ($p<0.05$). As the pre test and post test values are considered, significant differences have been observed in all groups except the control group ($p<0.05$). Considering the FT3 values, it has been also confirmed significant decreases both between the pre test and posttest findings ($p<0.05$) and in post treatment values ($p<0.05$) of all supplement and treatment groups except the control group. Likewise, as the FT4 values are examined, significant decreases have been observed between the pre test and post test and post treatment values of all supplement and treatment groups ($p<0.05$).

Discussion

In this study which aimed to examine the effect of the zinc supplement applied four times a week during 6 weeks along with the weight training on the physical, physiological and hematologic parameters, the TSH, FT3 and FT4 values were analyzed by examining the blood samples drawn twice from the subjects; the first one was for determining the pre-test (pre-supplement) resting period levels and the second one was for designating the post-test (post-supplement) resting period levels. Considering the variation in the hormone levels, 6-week zinc supplement created positive changes in thyroid functions. However, it was determined that these increases were more prominent in the zinc + training groups and the training group.

TABLE I: The Age, Height, Weight and Fat Values of the Research Groups.

Values	*Measurement*	*1st Group (Cont)*	*2nd Group (Zn)*	*3rd Group (Tra+Zn)*	*4th Group Training*
Age (Year)	I. Measurement	20.04 ± 2.20^{x}	21.02 ± 3.10^{x}	20.89 ± 2.06^{x}	20.44 ± 3.02^{x}
Height (Cm)	II. Measurement	174.52 ± 7.56^{x}	175.40 ± 8.25^{x}	175.08 ± 7.15^{x}	176.02 ± 7.20^{x}
Weight (Kg)	I. Pre test	76.60 ± 5.42^{ax}	75.22 ± 5.70^{ax}	75.84 ± 5.92^{ax}	74.63 ± 5.86^{ax}
	II. Post test	75.32 ± 6.90^{ay}	77.71 ± 5.57^{bx}	78.22 ± 6.12^{bx}	77.42 ± 6.08^{bx}

a,b,c; The differences in measurements that carry different letters at the same column are important ($p<0.05$).
x,y,z; The differences between the groups that carry different letters at the same line are important ($p<0.05$)
I. Measurement: Pre-Supplementation (Pre Test) II. Measurement: Post-Supplementation (post test).

Table II: The TSH, FT3 and FT4 Values of the Research Groups.

Values	*Measurement*	*1st Group (Cont) Mean±Sd*	*2nd Group (Zn) Mean±Sd*	*3rd Group (Ant+Zn) Mean±Sd*	*4th Group Training Mean±Sd*
TSH (uIU/mL)	I. Pre test	2.74 ± 0.74^{ax}	2.55 ± 0.87^{ay}	2.62 ± 0.96^{ax}	2.53 ± 0.90^{ay}
	II. Post test	2.77 ± 0.88^{ax}	2.42 ± 0.74^{by}	2.12 ± 0.92^{bz}	2.07 ± 0.92^{byz}
FT3 (pg/mL)	I. Pre test	3.84 ± 0.42^{ax}	3.76 ± 0.50^{ax}	3.70 ± 0.48^{ax}	3.80 ± 0.44^{ax}
	II. Post test	378 ± 0.70^{ax}	3.54 ± 0.58^{by}	3.52 ± 0.36^{by}	3.66 ± 0.38^{byz}
FT4 (ng/dL)	I. Pre test	1.53 ± 0.2^{ax}	1.58 ± 0.16^{ax}	1.48 ± 0.18^{ax}	$1.55\pm0.10.2^{ax}$
	II. Post test	1.55 ± 18.4^{ax}	1.44 ± 0.1^{by}	1.32 ± 0.14^{bz}	1.33 ± 0.14^{bz}

*The Differences Between the Averages at the Same Column Are Important ($p<0.05$).
a.b; The Differences in Measurements that Carry Different Letters at the Same Column Are Important ($p<0.05$).
x.y.z; The Differences Between the Groups that Carry Different Letters at the Same Line Are Important ($p<0.05$).

When the effect of doing exercises on the thyroid metabolism is studied, Akil et al. (20) found out that acute sub maximal exercises protocol led to considerable decreases in serum TSH, T3 and T4 levels in their study which studied the effect of sub maximal exercises on the thyroid hormone metabolism in sedentaries. Although the exercises protocol of the study examined the impact of acute exercises, they obtained similar results with our findings. In a study the results of which contradict with our findings, Fortunato et al. (11) emphasized any change was not observed in the serum TSH levels right after the exercises. It is thought that contradiction results from the difference in the exercise protocol because it is indicated that the type, intensity and period of exercise affect the TSH secretion (11), acute or regular exercise may cause changes in serum thyroid hormone levels (12). In another study, Cakmakci (8) studied the effect of anaerobic exercises on certain hormone levels of the athletes from different branches and found out the wingate test for anaerobic power increased the ft4 and tt levels of the football players and the tsh, ft4 and tt levels of the tae kwon-do athletes. In another study, Harbili et al. (21), in their study conducted upon 17 handball players aged 19.25±1.77, applied 6 repeat maximal (6 TM) strength training every other day throughout 6 weeks and at the end of the study they found out the exercise program increased the T4 and TT release. In another study the results of which reinforce our findings, Simsch et al. (22) ascertained the TSH and T3 levels of the oarsman decreased significantly after the resistance training; and also in contradistinction to our study they did not observed an changes in the T4 levels. Beyleroglu (23) ascertained significant decreases in the TSH and FT3 values of the field hockey players after maximal aerobic exercises; however, he emphasized it was not observed any changes in FT4 values. This study relatively supports our findings. Huang et al. (24) put forth significant decreases in only TSH values at thyroid metabolism after treadmill exercises.

In studies that study the effect of zinc supplement on the thyroid hormone functions, it has been claimed zinc, particularly T3, has positive impacts on thyroid hormone functions (25, 26). In a study the results of which contradict with our findings, Nascimento Marreiro et al. (27) researched the effect of zinc supplement on the thyroid hormone metabolism in adolescents with down's syndrome and found out zinc supplement did not affect the thyroid metabolism. In another study conducted upon rats, Baltaci et al. (28) determined the zinc supplement caused decreases in FT3 and T3 values. Kilic et al. (29) identified significant increases in resting and fatigue TT3, TT4 and FT3 values of the wrestlers given zinc supplement for 4 weeks. In a similar study, Kilic (30) found out 4-week zinc supplement led to decreases in the thyroid hormone levels of sedentary individuals, which shows parallelism with our findings.

Conclusion

Consequently, it can be said the zinc supplement applied four times a week during 6 weeks along with the weight lifting exercise lead to significant changes in the thyroid hormone levels of the athletes and sedentaries and forms an element supplement that can affect positively the athletic performance.

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