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Original Research

The effect of 6-week zinc supplement and weight training on the blood lipids of the sedentaries and athletes

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Abstract: In this study, we aimed to investigate the effect of 6 weeks of zinc supplementation and weight training on blood lipids of sedentary and athletes. Research group consists of total 40 males; 20 athletes who do regularly physical exercises and 20 sedentary volunteers. The volunteers were divided into four groups. These groups were constituted in that way: the first group is a natural sedentary group which called control group as well (S); the second group is another sedentary group which is supplied with only zinc (Z+S); the third group is training group which composing of athletes and is supplied with zinc (Z+T); the fourth group is the natural training group or athletes (T). From the beginning of the study to the end of 6-weeks of training, the participants gave blood samples before and after every application order to measure the total cholesterol, LDL cholesterol and HDL cholesterol and the levels of Triglyceride. This study identifies that the values of the total cholesterol, LDL cholesterol and Triglyceride of the groups which were supplied with zinc supplement decreased, whereas the levels of HDL cholesterol increased in these groups. Consequently, this work demonstrates that the 6-weeks zinc supplement and training can make a significant contribution to the performance by changing positively the levels of blood lipid.

Key words: Training; Lipid; Zinc supplement; Cholesterol; Sedentary.

Introduction

The zinc is a mineral that plays a vital role in several biological processes such as enzyme activity, cell membrane stabilization, gene expression and cell stimulation (1). Furthermore, zinc is the fourth most abundant intercellular metal in organisms and a molecule that is presented in over 200 enzymes and proteins (2). In a human body that is approximately 70 kg contains 2-3 grams of zinc which is the most abundant trace metal found in human body after iron, and most of it are found in intercellular areas (3). Zinc is an essential mineral for organism and is to be taken to certain amount in order to have an optimal health (4). The recommended daily amount is 11 mg for men and 8 mg for women (5). The shortage of zinc, in a body, affects the performance during sport activities. To exemplify, the athletes with zinc deficiency generate less power during activity and reach high levels of blood lactate at the end of training (6). Cinar et al., (2007) examined the effect of training programme on minerals in their study, and they recorded the value of zinc as 92.70 before the application, on the other hand, they measured this value as 96.20 after the application (7). Some studies conducted on human have indicated that zinc supplement decreases the levels of total cholesterol, LDL cholesterol and triglyceride, whereas it increases the level of HDL cholesterol (8, 9). In addition to that, it was reported that zinc has effects on LDL and HDL cholesterol (10, 11). Hughes and Samman (2006) confirmed that HDL cholesterol tended to decrease after the applying of zinc supplement (12). In the another studies examining the effects of zinc on blood lipids, Afkhami-Ardekani et al. (2008) analyzed the effects of zinc supplement on blood lipids of patients who have type 2 diabetes, and they found out that one and a half months zinc supplement caused a decrease in total cholesterol, LDL cholesterol and the amount of triglyceride (13). Moreover, Hercberg et al. (2005) examined the effects of zinc supplement among healthy individuals, and they figured out that the zinc supplement created positive changes in HDL cholesterol only in males, but it did not make any difference in the values of other lipids (14). Foster et al. (2013) analyzed the effects of zinc sulphate supplement on patients who have type 2 diabetes. After applying zinc sulphate supplements 40mg per a day during 3-months, and they pointed out the zinc sulphate supplement did not cause any difference in the values of lipid among patients of type 2 diabetes (15). In another study, Gunasekara et al. (2011) stated that a 4-months zinc supplement created positive changes on all blood lipids (16). Hininger-Favier et al. (2007) determined that a 6-months zinc gluconate supplement which was supplied to healthy individuals in amount of 15 mg and 30 mg per a day had no effect on the values of lipid (17). On the contrary, Li et al. (2010) found out that a daily 15 mg zinc supplement that was applied on obese individuals for six-and-a-half- months affected positively all parameters of lipids excluding triglyceride (18). In a similar study, Payahoo et al. (2013) emphasized that after applying daily 30 mg zinc supplement during a month on obese individuals, we observed a decrease in the values of triglyceride, whereas any changes were not seen in the other parameters (19).

In addition to the short-time effects of doing exercises on the zinc metabolism, it is known that doing regular high grade exercises may affect the metabolism of zinc in the long-term (20). Based on these arguments, it is asserted that doing exercises have significant effects on carbohydrates, protein and lipid metabolisms. However, John W. Hadden (1998) thinks that zinc which plays a fundamental role in cell division and growth and the functions of enzymes can have critical effects on physical performance.

The aim of that study is to examine the effect of 6-weeks zinc supplement and weight training on blood lipids (the total cholesterol, LDL cholesterol, HDL cholesterol and triglyceride) in sedentaries and athletes (21).

Materials and Methods

Subjects

The study was carried out in accordance with the Declaration of Helsinki, and it was approved by the local ethics committee (2011/04-1). All the participants provided signed written informed consent prior to the study. 40 healty males ranging in age from 18 to 22 participated in this study. The subjects were equally divided into 4 groups. The pretest-posttest design was used in that study.

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

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

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

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

The second and third group were supplied with zinc (2.5-3 mg /day) in addition to the normal diet for 6 weeks. Furthermore, the third and fourth group did weight lifting for 90-120 minutes 4 days in a week throughout 6 weeks. The first group which represented the control group did not take any supplements, nor did they do any training.

Identification of the subjects' lipid parameters

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, the levels of triglyceride, HDL, LDL and VLDL cholesterol were examined.

Examination of the blood samples

The blood samples were centrifuged at 3000 rpm³ for 10 minutes and the blood plasma fractionation was done. The measurement of the plasma parameters was carried out in the Biochemistry laboratory of Özel Işıl Kardiyoloji Merkezi (Private Işıl Cardiology Center) which operates in Diyarbakır. The analysis of Total Cholesterol, Triglyceride, HDL and LDL were done through the Enzymatic Colometric method by using the BT3000 biochemistry auto analyzer.

Statistical analyses

The variance analysis is used to identify 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 which have distinctions. The groups were compared by t-test in order to determine differences among the measurements (22). The statistical analyses were conducted via SPSS 16.0.

Results

When the body weight values given at the Table 1 were examined, it was not observed any difference among the measurements of the 1st Group ($p>0.05$). It was determined a statistical difference between the pretest and posttest values of the 2nd, 3rd and 4th groups, and the 6-weeks zinc supplement and weight training decreased significantly the body weight ($p<0.05$). As the decrease in the body weight was compared to in-group values and the control group, it was recognized that there was a decrease between the groups ($p<0.05$). While it was not identified any differences between the pretest and posttest values of the percentage of body fat ($p>0.05$), a significant decrease was observed in the training and zinc+training groups at the comparisons implemented after the application ($p<0.05$).

At the Table 2, the values of total, HDL, LDL cholesterol and triglyceride of the groups were provided. As the total cholesterol values were examined, it was observed a decrease in the training and the supplement groups after the application ($p<0.05$). When the pretest and posttest values were analyzed, a statistically significant difference was identified with the values of the training and zinc+training groups ($p<0.05$). While any difference was not found in the values of HDL cholesterol after the application ($p<0.05$), it was determined a difference only in the pretest and posttest values of zinc

Table 1. The Age, Height, Weight and Fat Values of the Research Groups.

	Measurements	1st Group (Cont)	2ndGroup (Zn)	3rdGroup (Tra+Zn)	4thTraining
Age (Year)	Pre-test	20.04±2.20x	21.02±3.10x	20.89±2.06x	20.44±3.02x
Height (Cm)	Pre-test	174.52±7.56x	175.40±8.25x	175.08±7.15x	176.02±7.20x
Weight (Kg)	Pre-test	76.60±5.42ax	75.22±5.70ax	75.84±5.92ax	74.63±5.86ax
	Post-test	75.32±6.90ay	77.71±5.57bx	78.22±6.12bx	77.42±6.08bx
Body Fat (%)	Pre-test	15.07±3.45ax	14.08±3.42ax	14.78±3.56ax	14.61±2.12ax
	Post-test	14.92±3.75ax	14.90±2.55ax	13.09±3.96ay	13.20±3.56ay

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 in Measurements that Carry Different Letters at the Same Line Are Important ($p<0.05$). Pre-test: Before supplementation. PostTest: Post-Supplementation.

Table 2. The Cholesterol, HDL, LDL and Triglyceride Values of the Research Groups.

	Measurements	1st Group (Cont)	2nd Group (Zn)	3rd Group (Tra+Zn)	4th Training
Total Cholesterol (µg/dL)	Pre-test	135.0±33.2 ax	140.2±32.9 ax	146.0±42.4 ax	140.7±30.4 ax
	Post-test	138.5±28.9 ax	122.5±20.1 ay	105.6±31.7 bx	117.4±38.8 by
HDL (µg/dL)	Pre-test	39.5±12.1 ax	35.6±15.6 ax	40.8±16.4 ax	40.2±17.2 ax
	Post-test	38.1±18.4 ax	38.3±11.8 ax	41.5±18.8 bx	39.0±21.2 ax
LDL (µg/dL)	Pre-test	86.0±26.8 ax	87.8±32.5 ax	86.6±28.7 ax	82.0±17.7 ax
	Post-test	79.7±13.8 ax	74.3±16.5 ay	63.9±18.8 bz	69.5±21.8 bz
Triglyceride (mg/dL)	Pre-test	150.7±32.8 ax	168.4±11.6 ay	162.0±27.3 ay	142.9±31.2 ax
	Post-test	143.2±27.6 ax	105.1±15.7 ay	119.6±13.9 bz	112.0±19.1 by

* The Differences Between the Averages at the Same Columns 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 in Measurements that Carry Different Letters at the Same Line Are Important (p<0.05). Pre-test: Before supplementation. PostTest: Post-Supplementation.

+ training group (p<0.05). As the values of LDL cholesterol were examined, it was seen a difference between the pretest and posttest values of the zinc + training group (p<0.05). When the values of post-application compared, it was identified a considerable decrease in all groups excluding the control group (p<0.05). It can be found parallel values to the values of LDL cholesterol when the values of triglyceride were examined. Whereas a difference was identified between the pretest and posttest values of the training and zinc + training group (p<0.05), at the values which gained after application, it was specified a considerable decrease in all groups excluding the control (sedentary) group (p<0.05).

Discussion

The aim of this study is 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 in both athletes and sedentary. In this study, the values of Total, HDL, LDL cholesterol and triglyceride 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 lipid values, 6-weeks zinc supplement created positive changes in all aforementioned blood lipids. However, it was determined that these increases were more prominent in the zinc + training groups. Turkmen et al. (2010) compared the test values of the pre-exercise and post-exercises which is the 9-weeks aerobic endurance and strength training applied on the paramedic students groups, and they found out that the values of Body Weight (BW) and Body Fat Percentage (BFP) were statistically significant (23). These results are parallel to our findings on BW and BWP in our study. In another study which its results supports our findings, the experimental group did physical exercises 3 days a week for 60 minutes each day, and at the end of the 8-weeks training programme, Stasiulis et al. (2010) found out that the values of BMI, BWP and Triglyceride of the participants were decreased significantly (p<0.05) (24). In a similar study Colakoglu and Senel (2003) conducted a study on the effect of aerobic exercises on the body composition and blood lipids of the middle-aged women and found out a statistically significant decrease in body weight, resting heart rate, body fat percentage and LDL cholesterol of the subjects as compared the values of their pre-study, on the other hand, they emphasized that a considerable increase in the values of HDL cholesterol (P<0,05) (25). Koc and Tamer (2008) underlines that aerobic and aerobic trainings have positive effects on the body weight, body fat percentage and LDL and HDL cholesterol levels (26). Revan et al. (2011), in their study that examines the effects of aerobic training on the lipid profile, found out a significant decrease in body weight and values of triglyceride in the training group while they observed a noteworthy increase in the levels of HDL cholesterol. In contrary to our findings, the levels of total cholesterol and LDL cholesterol did not show a critical alteration in both training and control groups (27).

It is seen that different results were obtained in the studies that researched the relationship between exercises and element. Whereas increases were observed in some studies (28). it was not seen any change in other studies (8,29,30). Considering the effects of zinc supplement on the blood lipids in our study, it was observed the sole zinc supplement and zinc supplement provided with training ensured a decrease in the values of total cholesterol, LDL cholesterol and triglyceride (p<0.05). As for the value of HDL cholesterol, it was determined that zinc supplement did not create any difference, but it can be observed an increase in the value of HDL when the zinc supplement was applied with training. In consequence of the zinc supplement given to the obese children, Hashemipour et al. (2009) did not confirm any statistically significant increase in BMI, LDL cholesterol and triglyceride levels of the participants (8). In a similar study, Saritas et al. (2011) studied on the effects of swimming exercises supplied with mineral supplement on blood parameters. They identified the mineral supplement was an ineffective for the values of HDL and LDL cholesterol and total cholesterol (31).

In another study, a daily 30 mg zinc supplement were provided to the Korean obese women during 8 weeks, and it was not identified any change in blood pressure, blood glucose, triglyceride and HDL cholesterol at the end of the study (29). These findings are in contrary to our results. It can be thought that the reason behind this discrepancy is training programme. Erdemir et al. (2005) researched the effects of mineral supplement in the endurance athletes' max. VO2 and blood parameters (cholesterol, glucose, triglyceride, HDL, LDL cholesterol and total protein) and found out there was not any difference between the blood values of the group supplied with placebo and mineral (32). It is thought the reason for that circumstance is differences between the bee's pollen and zinc were supplied as supplements. In a parallel study, Fostera et al. (2010) emphasized that zinc supplement generally did not have an effect on the plasma cholesterol, LDL and HDL cholesterol and plasma triglyceride concentration at the end of their meta-analysis study (30). Contrary to these studies, in the study of Roozbeh et al. (2009) showing parallelism to our findings, they ascertained a statistically significant difference in the values of total cholesterol, LDL and HDL cholesterol and serum triglyceride of the hemodialysis patients after they were provided with zinc supplement for 42 days, and their study supports our findings. In another study, it is reported the zinc supplement has positive effects on the plasma lipid parameters and decreases significantly the total cholesterol, LDL cholesterol and triglyceride level (28).

When examining the effect of doing exercises on blood lipids, it was confirmed that both doing exercises reinforced with zinc supplement and solely doing exercises created crucial decreases in blood lipids. Nonetheless, any difference was not observed in the values of HDL cholesterol of the group which trained, but not supplied with zinc. Aydogan (2013) applied a 6-week exercise programme on sedentary housewives. At the end of the study, although it was seen an increase in the values of total HDL cholesterol and triglyceride and a decrease in the value of LDL cholesterol, these findings were not regarded statistically significant (33). Iri et al. (2010) implemented 8-weeks walking exercises to women. After all measurements of percipients, they determined significant decreases in the values of weight, body fat percentage, HDL and LDL cholesterol of the participants ($p < 0.05$), but they could not identify any differences in the values of cholesterol and triglyceride ($p < 0.05$) (34). Akbulut (2011) observed a critical decrease in the values of body weight, body fat percentage, body mass index, total cholesterol and LDL cholesterol of the participants as consequences of his study which examined the effects of doing aerobic exercises on the body composition and blood lipids of sedentary women (35). In another study, Vatansev and Cakmakci (2010) studied the effects of doing 8-weeks step-aerobic exercise on certain biochemical parameters among sedentary individuals (36). The results of the Obese (O) and Overweight (OW) individuals were assessed as the values of pre-exercise and post-exercise in their groups, and these groups were compared. Based on that, a significant increase was identified in the levels of pre-exercise and post-exercise HDL cholesterol of the O group and OW group ($p < 0.05$). It was determined a statistically significant increase in the values of HDL cholesterol of both groups ($p < 0.05$). While a significant decrease was observed in the levels of pre-exercise and post-exercise LDL cholesterol of the Overweight (OW), an increase was seen in the values of O group. It was ascertained a crucial decrease in the values of pre-exercise and post-exercise triglyceride of the obese group. It was observed an insignificant decrease in the values of triglyceride of the overweight group ($p > 0.05$) and yet a significant decrease in the values of the obese group. Bicer and Kaldırımcı (2008) examined the effects of doing aerobic and aerobic exercises supported by weight training on the serum lipids of the sedentary women. In consequence of that study, it was found out a statistically significant increase in the HDL cholesterol parameters ($p<0.01$). It was confirmed the exercise time had a critical effect on the HDL and LDL cholesterol ($p<0.0l$). A significant decrease was seen in the levels of triglyceride ($p < 0.01$) (37). Kocyigit et al. (2011) researched the effects of mineral supplement on the liver enzymes and plasma lipids of the football and basketball players. At the end of the study, the levels of HDL cholesterol of all athletes increased after the mineral supplement ($P<0.001$). In the basketball players, the levels of LDL cholesterol and triglyceride decreased after the mineral supplement ($P<0.01$) (38). The findings of the study conducted by Cengiz et al. (2013) reinforce our findings. It was determined a positive change in the levels of total cholesterol, LDL cholesterol, HDL cholesterol and triglyceride of the groups provided with zinc supplement depending upon the exercise and supplement (39).

As a result, this study proves that the zinc supplement applying along with weight training 4 times a week during the 6 weeks have significant changes on the blood lipids, body weight and the percentage of body fat of both the athletes and sedentaries. These important changes provide an increasing in the value zinc in the metabolism and show that the zinc supplement has able to create a positive effect on the blood lipids and physical performance.

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