Effects of Two Months of Physical Activity on the Copper Level of Overweight Sedentary Young Male and Female Measured at Nano Scale Level

Afshin Salehi[1],Hassan Ehtram[2], SaeidSoukhtehzari[3], Mansour Sayyah[4*], Manzardokht Bigdeli[5]

[1]College of Paramedics, Kashan University of Medical Sciences, Kashan, I.R. Iran
[2] College of Medicine, Faculty member of Kashan University of Medical Sciences, Kashan, I.R. Iran
[3]Shahid Beheshti University of Medical Sciences, Tehran, I.R. Iran
[4]College of Medicine, Affiliated Faculty member of Trauma Research Center, Kashan University of Medical Sciences, Kashan, I.R. Iran
[5]master of Sciences, Exercise Physiology, Kashan University of Medical Sciences, Kashan, I.R. Iran

***Corresponding author**: Mansour Sayyah, College of Medicine, Affiliated Faculty member of Trauma Research Center, Kashan University of Medical Sciences, Kashan, I.R. Iran, E-mail: Mansorsayyah@yahoo.com

Abstract: Many chemical elements at trace level in human body play vital role in health and Copper is one of them. Exercise changes the level of many chemical elements. The purpose of this research was to examine the effects of exercise on the copper level of overweight male and female measured at nano scale level.23 healthy overweight young male and female performed aerobic exercise two times per week. The blood sample was collected prior to the start and at the end of the program. They performed submaximal exercise. Statistical analysis using t-test indicated that there was a significant increase in the level of copper of both groups (P=0.07, P =0.0001).No significant difference between the level of copper between the men and women in posttest was present. No significant differences between the pretest and posttest level of copper in both groups was found (p>0.05). The results demonstrated that two months of exercise increased the level of serum copper in male and female subjects. Therefore, there is no change in hemostasis level of the subjects who participate in this kind of activity and there no need to consume supplementary copper during the physical activity exercise.

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Introduction

Some trace elements such as iron (Fe), zinc (Zn), and copper (Cu) are essential minerals, play significant roles in the regulation of the whole body metabolism including energy utilization and work performance [1]. Their excessive intake causes toxic symptoms, and insufficient intake induces deficiency symptoms [2]. Cu known as copper is a component of antioxidant enzymes that acts to protect the organism against the action of free radicals, especially in cardiovascular diseases. An imbalance in the metabolism of Cu might trigger hypercholesterolemia and disorders in oxidative stress [3].The possible metabolic disorders present in a number of chronic diseases such as obesity, which, in turn, might originate from deficiency or excess of minerals, has awoken the recent interest for studies assessing copper (Cu) and other trace elements [4–6].Considering that Cu disorders have been associated with lipoprotein oxidation in obese patients, the early detection of these disorders is important for guiding clinical behavior related to obesity co morbidity prevention [7].For sportsmen, adequate amounts of these minerals are required for physical training and performance. Studies of sportsmen during training, as compared to non-training control subjects, indicate the potential for increased losses of minerals in sweat. Some studies report sub-optimal intakes of minerals, particularly among sportsmen who are actively attempting to lose weight to meet standards for competition [8].The relation between Cu and elevated total cholesterol (TC) plasma levels and the low-density lipoprotein cholesterol (LDL-c) fraction, has been demonstrated in patients suffering myocardial infarction. However, both Cu deficiency and high plasma concentrations of this mineral seem to have an atherogenic effect (9).Studies that have examined acute effects of strenuous exercise on copper status have shown varied results [10, 11]. Marrellaet. al. [12] reported that physical exercise affected trace element metabolism, while Anderson et. al. [13] stated that urinary zinc and copper levels of athletes did not change after acute exercise. It was noted that heavy physical exercise could impair trace element metabolism, thereby inhibiting the immune system and causing infections, and the importance of this topic was emphasized in terms of not only performance but also athlete health [13].The trained status reached by regular physical

activity induces an alteration in the body mineral homeostasis [14, 15]. Studies that have examined acute effects of strenuous exercise on copper status have shown varied results [16, 17]. For example, plasma copper concentrations fall after treadmill exercise in human volunteers [18]. In contrast, women performing a marathon run have increased plasma copper with no change in erythrocyte copper contents [16]. In a different study, a marathon run induces a small increase in plasma copper concentration, but, at the same time, produces a decrease in total blood cell copper concentration [18]. Other aerobic exercises in humans, as well as swimming to exhaustion by animal, increases serum or plasma copper concentrations [16, 20]. On the other hand, highly variable responses of plasma copper are seen following cycle ergometer exertion in human volunteers [21]. Finally, some forms of aerobic exercise are reported to increase urinary copper losses [22]. Different researchers reported conflicting results in regard to the effect of exercise on the mineral level of blood serum. In addition, there were different results due to the participation of individual with different body status such as athletes versus non-athletes to mention a few. Therefore, the present research was designed to examine the changes in the concentration of serum copper level following participation in 8 weeks of aerobic exercise.

Methodology

This was semi-experimental research in which 23 healthy overweight sedentary young male and female subjects were selected through simple sampling method. They voluntarily participated in two months of progressively increasing aerobic running exercise two times per week. All the participants were healthy and had no recent history of medication or illness. Following the detailed explanation about the exercise protocol given by the researcher, the participants completed a human consent form. The participants attended the sport area where they performed the exercise program. They were advised to avoid any diet change or participation in any extra physical activity during the research protocol.One day prior to the start of the exercise protocol, the subjects attended a pathology lab and 5 cc of fasting venous blood was collected by the lab technician. The blood samples were kept at the lab. The level of serum copper levels was measured at nano gram per micro liter by biochemical analyzer set model Hitachi 717. Similar procedure was followed after the termination of exercise program. The exercise program included 45 minutes of running at 70 to 85 percent of their aerobic working capacity determined by using maximum heart rate monitored by polar watch. Every week the running time was increased by 2 minutes. Statistical analysis was performed on the data using dependent and indecent t-test by employing SPSS:PC software version 14.0.the level of significance was set to alpha equal to 0.05.

Results

Demographic information including weight, height and age of the subjects were obtained and recorded. Table 1 presents these data.The result of analysis indicated that there was no significant differences between the age and weight of the male and female subjects (P=0.39 and P= 0.12). However, the height of male subjects were significantly more than the female subjects (P=0.0001).

Table 1: Demographic characteristics of the groups according to gender

Gender / variables	male		female		p-value
	mean	Standard deviation	mean	Standard deviation	
age	21.5	1.7	22.1	1.57	0.39
weight	82.5	5.6	86.5	6.5	0.12
height	166.5	6.4	178.2	5.6	0.0001

The result of analysis of demographic data is presented in table 1. Kolmogorov-smirinov test was used to test the normality of the data. The result indicated that the copper distribution was normal; therefore, parametric tests were used to compare the means. A pretest comparing the mean values of copper of men versus women indicated that there was no significant difference between these two means (P=0.85). Table 2 shows the result of comparing copper value in pretest and posttest condition of men versus women. As it can be observed, there was no significant difference between the mean values of copper in men compared to women during the pretest state nor there was a significant difference between the men compared to women during the posttest state (P=0.40, P=0.59).

Table 2.Comparing the mean value of copper in men versus women in pretest condition

Test time	gender	Mean(ng/µ l)	Standard deviation (ng/µl)	P-value
Pretest	male	85.22	16.2	0.40
	female	80.4	9.5	
Post test	male	93.5	12.9	0.59
	female	95.4	6.8	

Table 3.Comparing the copper (ng/µl) level at pretest and posttest condition according to the gender

gender	stage	mean	Standard deviation	t-value	p-value
male	pretest	80.4	9.5	7.81	0.0001
	posttest	95.4	6.8		
female	pretest	85.22	16.2	2.79	0.017
	posttest	93.05	12.9		

The result of analysis indicated that there was a significant difference between the pretest and posttest mean value of copper in female (P=0.017) and male subjects as well (P=0.0001). These results are presented in table 3.These results are also shown in figure 1.

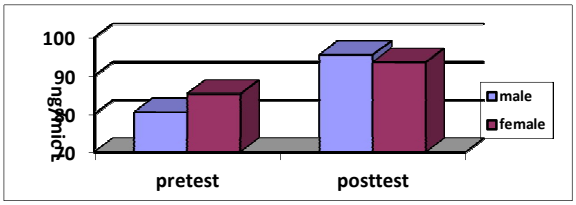

Figure 1: Comparing the mean values of copper in ng/µl of male and female in pretest and posttest state

In table 3, the mean values of serum level of copper is presented in nano gram per microliter. The result of independent t-test revealed that there was a significant increase in the serum level of copper value of 80.4 to 95.4 nano gram per microliter (ng/µl) in overweight men after 8 weeks of progressively increased aerobic exercise (P=0.0001). In addition, there was a significant increase in the serum level of copper value of 85.2 to 93.05 nano gram per microliterin overweightwomenafter 8 weeks of progressively increased aerobic exercise (P=0.0 17). The result of analysis of data indicated that there was no significant difference between the mean values of copper in men compared to women (P=0.53).

Discussion and Conclusion

This research was conducted to determine the effect of 8 weeks of aerobic activity on the changes of serum copper (ng/µl) level of overweight men and women. The results indicated that both the mean value of serum copper level (ng/µl) increased significantly in both sexes (P>0.05). Copper in trace amount is very important in regulating total body metabolism, energy expenditure and physical activity [1]. Following a physical activity period, sweating occurs. During sweating a considerable amount of minerals including copper are expelled from the body. The shortage of copper in body causes disturbances such as weight loss in athletes. Weight loss that occurs this way can weaken the performance ability of an athlete. The participants in this research performed two sessions of progressively increased aerobic exercise by adding extra distance every week for eight weeks. This training sessions increased the mean level of serum copper (ng/µl) of men by 15 (ng/µl), an increase of 16.85 (ng/µl). This increase level for the women subjects was 7.83 (ng/µl), an increase of 9.8 percent. Both of these changes were statistically significant. Research results indicate that physical activities result in different changes in serum copper level [14, 15). For instance, in a research that examined the effect of participation in physical activity on serum copper level, the subject participated in a running exercise program on treadmill and the result indicated that the serum level of copper was decreased after the running exercise [18]. On the contrary, in another research it was demonstrated that performing physical activity by women led to the increase in the level of serum copper [19]. In the present research, the serum level of copper increased. This finding is in agreement with the findings of Deuster and associates (1991) [20], Marrella and associates (1993) [18]. However, the result of this research is not in agreement with the findings of Pourveghar(2009) [24], whose subjectsperformed the Bruce protocol as their training program for 18 minutes whereas the participants in the present research performed 8 weeks of running progressively increased program. It is likely that the difference in the findings of these two researches is due to the different nature of the exercise programs. It seems like physical activity causes different changes in the concentration of the important mineral, particularly copper. In addition, the duration of the activity is another important factor that can have significant effect on the level of change of serum copper. Therefore, the athletes and non-athlete

individuals who take part in intense physical activity, there is no need to consume copper supplement to maintain the level of serum copper.

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