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Comparison of Plasma NPY and Zinc Levels of Elite Weightlifters and Sedentaries*

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Abstract

Neuropeptide Y (NPY), a strong stimulant of nutrition, and zinc, which has an important effect on nutrition regulation, have attracted the attention of many researchers. The aim of this study was to investigate the relationship between plasma NPY and zinc levels in elite weightlifters. Thirty healthy subjects between the ages of 18-27 participated in the study voluntarily. The subjects were composed of two equal groups: the control group who did not exercise regularly and the elite weightlifters who did regular training. Plasma NPY (ELISA) and zinc levels (Atomic Absorption Spectrophotometer) were determined in blood samples collected from subjects. Statistical evaluation of the data was performed using Minitab for Windows, Release 13.0 computer software. Arithmetic means and standard deviations of all parameters were calculated. Variance analysis was used to determine the differences between groups. The Least Significant Difference Test (LSD) was employed to compare group means obtained from the variance analyses that were found statistically significant. When serum NPY and zinc values were compared between the groups, it was found that NPY levels of elite weightlifters were higher than controls ($p < 0.01$) and zinc levels were lower ($p < 0.01$). The findings of the study show that physical activity leads to changes in NPY and zinc release. As a result, there may be a critical relationship between these changes and physical performance.

Keywords: Elite Weightlifter, Sedentary, NPY, Zinc

Elit Haltercilerle Sedanterlerin Plazma NPY ve Çinko Düzeylerinin Karşılaştırılması

Özet

Beslenmenin kuvvetli bir uyarıcısı olan nöropeptid Y (NPY) ile beslenmenin düzenlenmesinde önemli bir etkiye sahip olan çinkonun bir arada egzersizle ilişkisi birçok araştırıcının dikkatini çekmiştir. Bu çalışmanın amacı elit haltercilerde plazma NPY ve çinko düzeyleri arasındaki ilişkinin araştırılmasıdır. Çalışmaya 18-27 yaş aralığında 30 sağlıklı denek gönüllü katılmıştır. Denekler düzenli egzersiz yapmayan kontrol grubu ve düzenli antrenman yapan elit halterciler olmak üzere eşit sayıda iki gruba ayrıldı. Deneklerden toplanan kan örneklerinde plazma NPY (ELISA) ve çinko düzeyleri (Atomik Absorpsiyon Spektrofotometresi) tayin edildi. Verilerin istatistiksel değerlendirmesi Minitab for Windows, Sürüm 13.0 bilgisayar yazılımı kullanılarak yapıldı. Tüm parametrelerin aritmetik ortalamaları ve standart sapmaları hesaplandı. Gruplar arasındaki farklılıkları belirlemek için varyans analizi kullanıldı. İstatistiksel olarak anlamlı bulunan varyans analizlerinden elde edilen grup ortalamalarını karşılaştırmak için Asgari Önemli Fark Testi (AÖF) kullanıldı. Serum NPY ve çinko değerleri gruplar arasında mukayese edildiğinde elit haltercilerin NPY düzeylerinin kontrollerinden yüksek ($p<0.01$), çinko düzeylerinin ise düşük bulunduğu tespit edilmiştir ($p<0.01$). Çalışmanın sonucunda elde edilen bulgular, fiziksel aktivitenin NPY ve çinko salınımında değişikliklere yol açtığını göstermektedir. Sonuç olarak bu değişiklikler ile fiziksel performans arasında kritik bir ilişkinin olabileceği söylenebilir.

Anahtar kelimeler: Elit Halterci, Sedanter, NPY, Çinko

INTRODUCTION

Neuropeptide Y (NPY) is a neuratransmitter or neuromodulator peptide consisting of 36 amino acids (7). The most well-known effects of neuropeptide Y are on nutrition. These effects are seen by central NPY injection in the hypothalamus and are involved in normal or pathological changes of appetite (30). In humans, NPY has been reported to be released from the circulation in response to sympathetic activation with a range of stimuli such as hypoglycemia, exercise, and acute stress. In addition, NPY and its receptors are known to be released from the central nervous system, many brain regions, spinal cord and especially the sympathetic nervous system (30,19).

NPY, which plays a leading role in regulating eating behavior and energy expenditure by reducing physical activity, leads to a decrease in motor activity, heart rate and blood pressure (24). However, there is limited evidence of NPY's responses to exercise. Karamouzis et al. (12) reported an increase in NPY values in response to marathon swimming exercises. Chen et al. (3) stated that NPY levels in mice continued to increase after exercise and this situation was statistically significant. It has been reported that high-intensity combined training applied to elite rowers significantly increases NPY levels (18). In another study to determine NPY levels in obese young men, it was reported that the increase in NPY levels after a single session of 30 minutes cycling exercise may be a triggering factor for the stimulation of consumed food (9).

Zinc, which has physiological functions such as growth, reproduction and immunity, is important for all living creatures and plays a role in the regulation of appetite. Zinc, the essential trace metal in the body, is a trace element that has several roles in important physiological processes as a signaling molecule. Changes in the concentration of neurotransmitters that occur at the hypothalamic level in general or locally due to changes in zinc levels cause a change in food intake (26,11). Zinc deficiency has been reported to cause various physiological problems such as loss of appetite, low body mass, anorexia, growth retardation, dermatitis, taste disorder and hypogonadism (26,11,25). Since zinc mediates the action of many hormones or is involved in the structure of numerous hormone receptors, zinc deficiency causes various functional impairment in hormone balance and the physiological and biochemical levels of many hormones are affected by zinc metabolism (15,22).

There are almost no studies on the relationship between NPY, which plays a pioneering role in the regulation of eating behavior and energy expenditure by reducing physical activity, and zinc, which have an important role in regulating appetite, with exercise. This study was performed to determine plasma NPY and zinc levels in elite weightlifters and to investigate their relationship with exercise.

MATERIAL AND METHOD

The subjects: Thirty healthy volunteers aged 18-27 participated in the study. Subjects were divided into 2 groups:

Group 1 (n=15), control group: The subjects of this group consisted of volunteer students from the School of Physical Education and Sports who did not train regularly.

Group 2 (n=15), experimental group: A group of elite weightlifters whose weight was selected for the national team, exercising regularly and taking measurements at rest during the camp.

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki.

Biochemical measurements:

Plasma Neuropeptide Y Analysis and Measurements: The analyses were carried out using Ray Bio NPY ELISA test kit (EIA-NPY). Values were read at 450 nm with BMG-LABTECH brand SPECTRO Star Nano Elisa Device (Germany). The values were calculated as pg/dl.

Plasma zinc measurements: Blood samples (2ml) collected from the subjects and put into heparinized tubes were centrifuged to separate plasma. The separated plasma was put into plastic-cap tubes and kept at -200C until analysis. Plasma zinc levels were determined in a Shimatsu ASC-600 model Atomic Absorption Spectrophotometer located in the Biochemistry Department of Elazig Firat University Medical School.Zinc levels were determined as µg dl-1.

Statistical Analysis:

Statistical evaluation of the data was performed using Minitab for Windows, Release 13.0 computer software. Arithmetic means and standard deviations of all parameters were calculated. Variance analysis was used to determine the differences between groups. The Least Significant Difference Test (LSD) was employed to compare group means obtained from the variance analyses that were found statistically significant.

RESULTS

Table 1. Serum NPY and zinc values of subjects

Group	NPY (pg/dl)	Zinc (μg/dl)
Control (n=15)	115.41 ± 11.26^{A}	127.10 ± 18.50^{A}
Elite Weightlifter (n=15)	133.12 ± 13.55^{B}	89.55 ± 13.70^{B}
p	0.01*	0.01*

*In the same column, the difference between the means with different letters is statistically significant (p <0.01).

In Table 1, NPY levels of elite weightlifters were found to be significantly higher than the control group (p <0.01). In contrast, serum zinc levels of the control group were significantly higher than elite weightlifters (p <0.01).

DISCUSSION AND CONCLUSION

In this study, when NPY and zinc values were compared between the groups, it was found that NPY levels of elite weightlifters were higher than controls and zinc levels were lower. Many researchers have emphasized the relationship between nutrition, development and maintenance of performance. Two methods are often used to determine the interaction between physical activity and nutrition. The first of these is to examine the physiological and performance responses by giving nutrients with different contents to the participants in the physical activity and to determine the effects of physical activity on nutrition (28). Therefore, it can be said that there is an increasing interest in investigating the relationship between exercise and minerals and elements (17).

There is little information about the effects of zinc, which is known to be an important trace element in energy metabolism, on performance. Studies on the relationship between zinc and exercise mostly focus on the distribution of this element in the body in response to exercise (16,4). There are few studies on the relationship between NPY, which is a strong stimulant of nutrition, and zinc, which have a significant effect on the regulation of nutrition, and exercise. There is a significant relationship between zinc and NPY regulation during anorexia caused by zinc deficiency (25). It has been reported that zinc deficiency contributes to the symptoms of anorexia nervosa and that the diet must contain an adequate amount of zinc to recover normal body weight during recuperation (20). Selvais et al. (21) showed that NPY mRNA increased in hypothalamus in zinc-deficient rats, but this increase in NPY levels could not be determined. Lee et al. (14) found that there was a 100% increase in NPY mRNA and a 50% increase in NPY levels in zinc deficiency. Marginal zinc deficiency has been reported to cause as low body mass as anorexia (23,8,27). Baltacı and Mogulkoç (1) found that NPY values were high in hypothyroidism and hyperthyroidism + zinc deficient groups in their study to investigate the effect of zinc supplementation and some hormones on thyroid dysfunction in rats. In addition to this study, hypo and hyperthyroidism groups have higher serum NPY values compared to the control group. No studies have reported a decrease in NPY levels in zinc deficiency (23). Despite increased NPY levels in zinc deficiency, this decrease in nutrition is defined as NPY resistance. The reasons causing this resistance; It is thought that pro-NPY may be related to deterioration in conversion to active NPY, decreased NPY secretion from neurons, and a decrease in NPY signaling (21,14,23). In our study, high NPY levels of elite weightlifters were probably higher than controls, possibly due to a decrease in zinc levels.

In our study, serum zinc levels of elite weightlifters (group 2) were found to be significantly lower compared to the control group. Long-term endurance training has been shown to significantly reduce serum zinc levels in both male and female athletes (10). The reduced zinc levels obtained in our study are consistent with the findings of Haralambie (10). The reduced zinc levels observed in endurance athletes can be explained by various mechanisms. However, the most important reason may be related to malnutrition from zinc (13). In addition, sweat and skin and zinc loss in athletes is known to be more than the non-athlete population (2). It is stated that moderate exercise increases the loss of zinc by sweat in athletes, but these losses may be higher in men than in women when the amount

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of sweating is taken into consideration (29). This phenomenon may be related to increased urinary loss of zinc as a result of skeletal muscle protein degradation observed in regular training athletes. Cordova and Alvarez (5) reported that as a result of the low serum concentration observed in athletes, the concentration of muscle zinc is also reduced. Since zinc is essential for many enzymes involved in metabolism, severe zinc deficiency will adversely affect muscle function. As a result, low muscle zinc levels will also reduce endurance capacity (6).

The most important event to be emphasized in our study is the decrease in serum zinc levels of elite weightlifters. Exercise zinc metabolism or zinc has important effects on exercise (16,4). The necessity of zinc for the activity of certain enzymes in energy metabolism and the reduction of muscle zinc levels in exercise may cause a decrease in endurance capacity, leading to muscle fatigue. In particular, the relationship between fatigue and zinc in exercise appears to be an issue that needs to be emphasized.

As a result of the study, it was determined that zinc levels were significantly lower in the individuals doing weightlifting exercises compared to the controls, and NPY levels increased significantly in parallel with the low zinc levels. It can be concluded that physical activity causes changes in NPY secretion and there may be a significant relationship between these changes and zinc. Especially in elite weightlifters, it can be suggested that physiological dose of zinc may be beneficial on performance due to the low serum zinc levels observed when compared with the control group.

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