THE STUDY OF ATHLETES' BLOOD SERUM PHOSPHORUS ALTERATIONS IN NANO GRAM PER MICRO LITER

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In this research, blood serum phosphorus alterations after performing an exhausting and intense aerobic exercise and its follow-up alterations after the subjects' 24 hours of rest has been investigated. Very insignificant alterations in nanogram per microliter (ng/microL) can cause extensive alterations in synthesis of Adenosine Triphosphate (ATP) and the metabolism. To this end, 12 male athlete students participated in an exhausting and intense aerobic exercise. In the morning of the test, 4cc blood samples were drawn from an elbow vein of the subjects. Then, the subjects were asked to run at the stadium for 15 minutes and when the running test was over, their blood samples were drawn again. The third stage of blood samples were drawn after 24 hours of rest. The results were analyzed using the SPSS statistical software. The comparisons between the serum phosphorus concentration means revealed that there is a significant difference between the first blood samples and the ones taken after performing the intense aerobic exercise (P=0.0001). On the other hand, no significant difference was observed between the first blood samples and the ones taken after the subjects' 24 hours of rest (P=0.181). Moreover, a significant difference was observed between the second stage blood samples, taken after performing the exhausting and intense exercise and the third stage (P=0.0001). The research results indicated that an exhausting and intense aerobic exercise can change the serum phosphorus even at the level of nanogram per micro liter. Furthermore, this research showed that the serum phosphorus can return to its early state after 24 hours of rest.

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1. Introduction

Phosphorus (P) plays an important role in several aspects of cellular metabolism, including adenosine triphosphate (ATP) synthesis, which is the source of energy for many cellular reactions, and 2, 3-diphosphoglycerate concentration, which regulates the dissociation of oxygen from hemoglobin. Phosphorus also is an important component of phospholipids in cell membranes. Changes in phosphorus content, concentration, or both, modulate the activity of a number of metabolic pathways. Major determinants of serum phosphorus concentration are dietary intake and gastrointestinal absorption of phosphorus, urinary excretion of phosphorus, and shifts between the intracellular and extra cellular spaces. Abnormalities in any of these steps can result either in hypophosphatemia or hyperphosphatemia [1, 2, 3].

Many researchers focus on the relation between diet and development and sustaining performance. Two methods are frequently employed to determine the relation between physical activity and diet. The first of these methods consists of giving foods with various ingredients to those engaged in physical activity and examining their physiological and performance responses while the second method comprises establishing the effects of physical activity on diet [4, 5]. Therefore, it can be said that there is a growing interest in research into the relation between exercise, minerals, and elements [6]. There is limited information about the effects of phosphorous, a trace element known to be important in the energy metabolism on performance [7].

Serum phosphorous levels have been reported to increase in response to intense anaerobic and aerobic exercise [8, 9]. The increase in serum phosphate is related in part to phosphate efflux from the intracellular stores in the muscle to the blood [9]. Furthermore, endurance athletes have been reported to have elevated resting serum phosphate levels or to be hyperphosphatemic (i.e., >1.35 mmol/L) [9, 10]. The cause of the elevated serum phosphate levels in trained endurance athletes has not been determined. However, Dale and associates [9] have suggested that it may represent a metabolic training effect and/or an inborn metabolic advantage [9].

Some authors [11, 12] have reported that intense exercise increases plasma concentrations of calcium and phosphorus and that, such exercise-induced increases, especially calcium, tend to return rapidly to baseline after exercise.

It should, however, be mentioned that the decrease of plasma phosphorus concentration may possibly have caused the decrease of endurance capacity because the plasma phosphorus level can influence the level of red blood cell 2,3-diphosphoglycerate, which is involved in the regulation of oxygen delivery to peripheral tissues [13, 14, 15].

Since such an exercise-induced increase in plasma phosphorus concentration is thought to be caused by the release of phosphate from the exercising muscles as a consequence of adenine nucleotide degradation [16]. In this research, it has been attempted to investigate blood serum phosphorus alterations after performing an exhausting and intense exercise. In addition, this study is conducted so as to follow up the probable changes after taking the 24- hour rest by subjects.

2. Methodology

Twelve male athlete students participated in this research. They were examined by a specialist and were all healthy. The subjects completed their health forms and were briefed about the objectives and stages of the research. The means of their weight, height, age, and body mass index (BMI) are respectively: (70.07 ± 2.23), (174.01 ± 3.12), (22.1 ± 4.29), and (21.23 ± 1.54). Further specifications are given in Table 1.

The subjects attended the stadium at 9 a.m. in a fasting state. In the first stage, 4cc blood samples were drawn from the participants' elbow vein while they were seated. Meanwhile, their heart rates were monitored using a polar meter watch. Then they divided into 2 groups for the ease of controlling their exercises. The participants were asked to perform the Balke run test and they ran fast and to the point of exhaustion at the stadium for 15 minutes. The researchers measured and recorded the covered distance. The means of the first and the second group of subjects' heart rate were recorded as 170-190 bets per minute. After finishing the exhausting running exercise, 4cc blood samples were drawn again and the subjects were allowed to rest for 24 hours. They were also recommended not to take any medication during the research. After 24 hours of rest, 4cc-blood samples were drawn for the third time. In each stage, the blood samples were transferred to a pathology laboratory. There, the samples were analyzed using the Biochemistry Analyzer Hitachi 717 device and the amounts of serum phosphorus concentration were measured in nanogram per micro liter (ng/mic L). SPSS statistical software version 14 was used for statistical data analysis. Means of blood serum phosphorus concentration in all three stages were measured using Paired Sample t test statistics in nanogram per micro liter.

Table 1. Characteristics of subjects on Rest Time before Exercise.

Variables	Mean	Standard Deviation
Weight (kg)	70.07	2.23
Height (cm)	174.01	3.12
Age(yr)	22.1	4.29
BMI (cm^2)	21.23	1.54
Systolic blood pressure (mm Hg)	110.01	2.76
Diastolic blood pressure (mm Hg)	80.1	2.34
$Vo_{2\ max}$ $ml^{-1}.\ min^{-1}$	52.46	2.02

3. Results

All specifications of subjects as well as the means of serum phosphorus concentration are presented in Table 2. In addition, P and t values of means are specified in Table 2 and the means are measured in ng/mic L. As it can be observed in Table 2, the mean of serum phosphorus concentration in the first stage is 32.3 nanogram per microliter while it has increased to 51.2 nanogram per microliter after the intense exercise. This increase is measured as 58.51% in ng/mic L and is significant (t=9.71), (P =0.0001). When the subjects rested for 24 hours, the mean of serum phosphorus concentration returned to its former state (30.4 ng/mic L). This decrease was measured 40.62% in ng/mic L and is significant too (t=13.16), (P=0.0001). From the comparison of the subjects' resting states, i.e. between the first and third stages, no significant difference was observed (t=1.44) (P=0.181). The comparisons of the differences between the three stages of blood serum phosphorus are shown in diagram 1.

4. Discussion and conclusions

This research is carried out so as to study serum phosphorus alterations in nanogram per micro liter. Since very slight alterations in serum phosphorus result in disorders in metabolism and the synthesis of Adenosine Triphosphate (ATP), ATP synthesis can provide living creatures with energy [1-3]. In this research, exhausting and intense exercise caused the mean of serum phosphorus concentration to increase by 51.20 ng/mic L and this increase is considered significant. This research is consistent with the one carried out by Fistad et al. (2001) in which they found a significant relation between exercise and alteration of serum phosphorus concentration. Furthermore, this research is also consistent with that of Bradle et al. and Dal et al. since these researchers have also claimed that the serum phosphorus concentration increases in response to aerobic and anaerobic exercises [8, 9]. It seems that during an exercise, serum phosphorus enters the blood through its stores in intercellular areas [9]. For this reason, aerobic exercises and the resulting stress caused serum phosphorus to increase by 18.9 ng/mic L in the second stage. This means that the 15-minute intense exercise has caused a significant change in serum phosphorus. On the other hand, there was the question of how much rest can return the serum phosphorus to its early state. In this research, when the subjects took rest for 24 hours, the serum phosphorus returned to its early state. The current research is consistent with the one conducted by Cade et al. [13]. One can conclude that different exercises can produce different responses in blood serum phosphorus. Training intensity and duration are also among the factors that can affect the results of research. More research is needed in order to gain reliable results from different exercises.

Table 2. Alterations of Phosphorus (P) According nanogram per microliter in three phases and P and T Values.

Variables (M±SD)	Variables (M±SD)	Standard Deviation	T – Values	P – Value
P Stage1 (32.30 ± 2.94)	P Stage2 (51.20 ± 5.78)	18.90	9.711	0.0001
P Stage1 (32.30 ± 2.94)	P Stage3 (30.40 ± 2.01)	1.90	1.448	0.181
P Stage2 (51.20 ± 5.78)	P Stage3 (30.40 ± 2.01)	20.80	13.196	0.0001

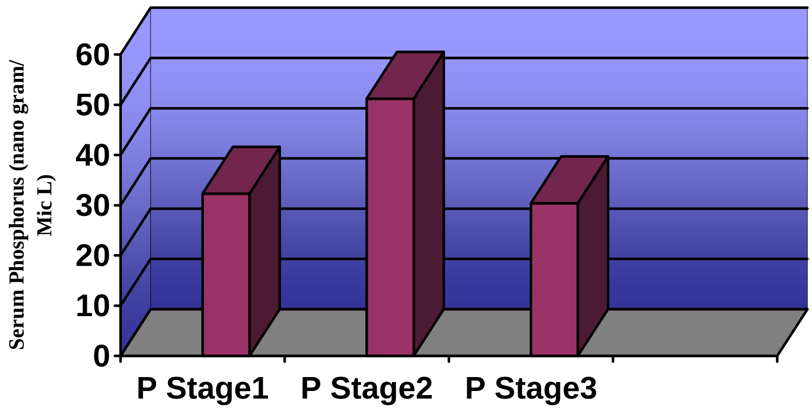

Fig. 1. Alteration of phosphorus according nanogram per microliter.

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