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Comparative Study of Blood Phosphate, Calcium, and Alkaline Phosphatase Level in Young Athlete and Non-athlete Men

[1]Raziyeh Nasrabadi, [2]Seyed Mahmoud Hejazi (PhD), [2]Mohammad Reza Ramazanpour (PhD)

[1]Student Department of Physical Education, Mashhad branch, Islamic Azad University, Mashhad, Iran
[2]Associate professor Department of Physical Education, Mashhad branch, Islamic Azad University, Mashhad, Iran

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ABSTRACT

Background: The impact of different exercises on bones health is relatively unknown. Exercise can affect bone metabolism and prevent osteoporosis. Therefore, this research was performed with the aim of comparative study of blood phosphate, calcium, and alkaline phosphatase level in young athlete and non-athlete men. **Materials and methods:** In this causal-comparative study, 24 athlete male referring to Brigand Azad University gym (including 12 with aerobic and 12 with anaerobic experiences) and 12 ordinary men without any background in sports were selected using available sampling method. Participants' weight and height was measured and recorded. Blood sample was prepared through arm vein, and sent to the lab. Data was analyzed using SPSS15 statistical software and statistical tests of one-way variance analysis and Take range follow-up at significance level of 0.05. **Results:** According to the results, the average level of alkaline phosphatase was significantly higher in aerobic group compared to control group. However, the average level of phosphate and calcium didn't represent a significant difference in three groups (P>0.05). **Conclusion:** Significant increase of alkaline phosphatase in aerobic group compared to control group indicates anabolic conditions due to exercise; however, different kinds of exercise do not influence phosphate and calcium indicators.

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INTRODUCTION

Bone loss and osteoporosis are a very important global problem not only for older generations, but also for young people who are, because of the modern way of life, becoming more and more sedentary, particularly in the time of life when the bone formation is at the peak [15]. Osteoporosis is multifactorial process that depends on several environmental factors, such as dietary calcium deficiency and genetic influences [7], and short duration of sunlight exposure *which* leads to vitamin D insufficiency [15].There are numerous factors involved in regulation of bone metabolism, from parathyroid hormone (PTH) involved in calcium level regulation, OPG and receptor activator of nuclear factor kappa B (RANK) in RANK signaling pathway, which play very important role in osteoclast differentiation and function [1], then, there are growth hormone (GH) and insulin-like growth factor (IGF), estrogens and androgens, thyroid hormone, cortisol and glucocorticoids and mechanical loading, all of which influences bone metabolism in different pathways, not well understood [1]. Mechanical strain affects osteocytes, the bone cells positioned between osteon lamellae, but the molecular details of the osteocytes' load sensor remain not quite understood [21]. SO, Biochemical markers explain changes in bone mass that the mechanical stress itself is translated into biochemical signals (Eyre). This theory suggests the bending or loading of a bone which acts as pulsed electric fields that induce bone cell activity leads to increased bone disposition at points of compression stress.

Alkaline phosphatase (ALP) is essential for mineralization has been known for more than 70 years but the more precise function of this enzyme is stilluncertain.To our knowledge, it is not known for how long ALP is attached to the GPI anchor before being released into the plasma, which is influenced by endogenous GPI-specific phospholipases. ALP might be a causative agent for the calcification process. It splits inorganic phosphate from organic phosphate and thereby increases the calcium-phosphate product, enabling mineralization it also splits inorganic pyrophosphate, a potent inhibitor of mineralization. There are also theories regarding the role of ALP, centering on regulation of cell proliferation and phosphate transport[6]. In humans

Corresponding Author: Seyed Mahmoud Hejazi, Associate professor Department of Physical Education, Mashhad branch, Islamic Azad University, Mashhad, Iran
Email: sm.hejazi37@gmail.com

there are four gene loci encoding for the ALP is enzymes: "tissue nonspecific," placental, germ cell, and small intestinal locus. ALP from the tissue nonspecific locus is expressed in tissues such as bone, liver, and kidney. However, it is possible to differentiate tissue specific ALP isoforms from this gene locus. Using high-performance liquid chromatography (HPLC), six different isoforms have been detected in serum: three bone—B/I, B1, and B2; and three liver—L1, L2, and L3 of ALP[14]. Another important factors in increasing bone mass are calcium and phosphorus, which are the materials that regulate heart rate, blood fractions, transmit nerve impulses, muscle contraction and formation of bones [11], and lead to an increase in osteoblasts. Biochemical markers, on the other hand, can be used to assess dynamic changes in bone turnover and appear to be sensitive enough to determine the bone response to a given exercise. Physical exercise has different beneficial effects on the skeleton according to the period of life which is undertaken, it optimizes peak bone mass in growing children [3]. Braham *et al* [4] demonstrated systemic effects of physical exercise on bone metabolism using serum bone markers, while Wallace *et al* [23] showed that endurance exercise transiently activates bone and collagen turnover. Few reports, however, are available concerning the effects of physical exercise on bone markers in a healthy aged population[10]. The aim of this research is the comparison the level of alkaline phosphatase, calcium and phosphorus in the blood of young men athletes and non- athletes men.

MATERIAL AND METHOD

This study is causal-comparative study, the sample of this study are 24 athlete male from Azad University of Brigand (12 men with a history of aerobic exercise,12 men with a history of anaerobic exercise) and 12 ordinary men without any background in sports who were free of any disease underwent medical history (osteoporotic hip or vertebral fractures ,cardiovascular disease, diabetes mellitus, smoking and excessive alcohol intake. The subjects were asked to complete a series of questionnaires concerning their medical history and physical activity. Blood pressure were taken with subjects seated upright after resting for ten minutes. vein blood samples were collected using standardized Procedure from all subjects at base level. Blood samples were drawn between 8 and9 in the morning. The samples were allowed to clot at room temperature and were allowed to clot at room temperature and were then centrifuged at 1000 rpm for 10 min. serum samples was stored at -80c until analysis. Total serum ALP, CA, P was measured by alp kit from pars AZMOON Company.

3. Statically analysis:

All data are expressed as means (SD).The distribution of variable was assessed by COLMONGROV SMIRNOVE. The difference between groups was assessed by one way ANOVA. A level of p<0/05 was considered significant. SPSS version 15 was used for statistical analysis.

4. Result:

Anthropometric data show that the average age of participant is in control= 25.33, aerobic exercise =24.75 and anaerobic exercise 25.33, and BMI:aerobic =22.31,anaerobic223.30 and control 22.17,and there is no significant difference between anthropometric data. The average level of alkaline phosphatase was had significant difference in 3 groups. However, the average level of phosphate and calcium didn't represent a significant difference in three groups (P>0.05).

Table 1: Serum data in 3 groups.

variable	Groups	mean	SD	F	P-value
ALP	aerobic	169.58	27.98	5.65	0/008
	Anaerobic	144.58	34.97		
	control	131.50	19.59		
CA	aerobic	8.50	0/47	0/02	0/98
	anaerobic	8.40	0/64		
	control	8.48	0/82		
P	aerobic	2.75	0/53	1.55	0/23
	anaerobic	2.79	0/42		
	control	2.63	0/57		

Table 2: Shows the result of post hoc test in 3 groups for ALP.

	Groups	p-value
control	Aerobic	0/006
	Anaerobic	0/50
anaerobic	aerobic	0/09

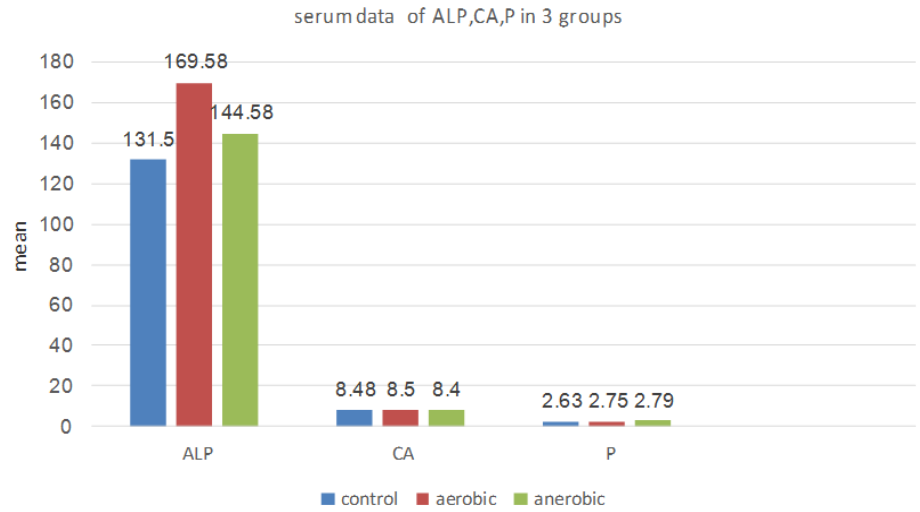

Fig. 1: Show the serum value of ALP, CA, P.

5. Discussion:

According to the results, the average level of alkaline phosphatase was significantly higher in aerobic group compared to control group. Our finding is agree with Guilement *et al* [9] reported a 45-50% increase in c-terminal TELOPEPTIDE region of collagen type 1 with no change in ALP for 2 H after 60 min of cycling. Fujimura *et al* [8] involved young males who conducted resistance training for 4 month and showed that biomarkers of bone formation OC and ALP elevated after 1 month of exercise. Rudberg [16] demonstrated that intense cycling, a non-weight bearing exercise, these rum concentration of bone ALP. They indicate mechanism of exercise induced influence on bone formation. Ramazanpoor *et al* [19] observed decrease in ALP in post - menopausal active women in comparison with inactive women. Bigeh *et al*, [2] showed no change in ALP after 6 month aerobic exercise in middle aged women. Nevi *et al* [18] showed no change in ALP in cyclist person in comparison non cyclist person. Lohmen *et al* [13] due to after 12 and 18 month of high intensity resistance training increased. Lester [12] showed resistance and combined exercise is more efficient for increasing bone formation marker levels.

The average level of phosphate and calcium didn't represent a significant difference in three groups (P>0.05).The finding of this study is agree with Gulimentand *et al* [9] and Zitterman, *et al* [24] Observed no f change in blood levels of calcium and phosphorus. But, Contrary to this findings and results, some studies have reported increased and decreased levels of calcium and phosphorus. In this context and Vera Coker [22] showed that physical exercise increases blood calcium levels. Maimoon, *et al* [17] studied the serum phosphorus and calcium levels in young male athletes and non-athlete and show Physical activity can affect serum CA and pconcentrations. Roghani and et al, showed the serum CA level significantly increased in the weighted-vest group after 6 weeks of exercise. Although serum P levels showed no significant increase in the weighted-vest group, the CA–P level remained balanced only in this group. Therefore, it seems that this form of exercise is more effective than simple aerobic exercise for bone formation.

6. Conclusion:

The present study demonstrates physical activity can stimulates bone formation and increase cortical bone mass as results of increased periosteal bone formation. In this study ALP increased in person do aerobic exercise, CA and had no significant change between groups. However to understand the interaction of bone response to exercise and to determine the type, intensity and duration optimized to achieve the maximum response of bone-conducted similar research with different training conditions are necessary. To maintain these changes, exercise must be a part of daily activity and emphasize the necessity of continuous training to achieve bone benefits.

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