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SOME DİFFERENCES IN PARAMETERS OF BONE MİNERAL METABOLİSM IN VARİOUS SPORT BRANCHES

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ABSTRACT

Objective

This study was carried out in order to compare the differences of laboratory parameters related to bone metabolism such as alkaline phosphatase (ALP), serum calcium (Ca), magnesium (Mg) and phosphorus (P), in various sport branches.

Material and Method

Serum alkaline phosphatase, calcium and phosphorus, and magnesium levels were measured in 23 skiers, 21 runners, 24 wrestlers, 20 handball, 21 soccers and 30 sedentary living healthy individual.

Results

The groups were matched according to age and sex. As expected, there were no significant differences according to age or the female-male ratio between the athletes and controls subjects ($p>0.05$).

Serum alkaline phosphatase (ALP), serum calcium (Ca), magnesium (Mg) and phosphorus (P) were determined in the athletes and the healthy control subjects. In all the athletes and controls, routine biochemical parameters including alkaline phosphatase (ALP), serum calcium (Ca), magnesium (Mg) and phosphorus (P) were within normal limits **(Table 1).** The wrestlers had lower levels of calcium compared to control subjects **($p<0,05$).** The runners and handball had higher levels of phosphatase compared to control subjects **($P<0,05$).** Other parameters had no significant difference between athletes and controls (Table 2).

Conclusion

When compared with control group, it has been found that wrestlers have low level of CA while runners and handball players have high level of P.

Key words*:* Serum alkaline phosphatase, calcium, magnesium, phosphorus and athletes.

Introduction

Serum alkaline phosphatase is a member of a family of zinc metalloprotein enzymes that function to split off a terminal phosphate group from an organic phosphate ester. This enzyme functions in an alkaline environment (optimum pH of 10). Alkaline Phosphatases are a group of enzymes found primarily the liver (isoenzyme ALP-1) and bone (isoenzyme ALP-2). The primary importance of measuring alkaline phosphatase is to check the possibility of bone disease or liver disease. For an adult, 50-75 mg/dl is considered a reasonable optimal range (O. Maldonado, R. Demasi , Y,Maldonado et al. 1998, N. McIntyre, S. Rosalki, 1991, AG,Lieverse, GG. van Essen, GJ, Beukeveld. et al. 1990). Calcium is the basic mineral component of the skeleton and plays major roles in neurologic

transmission, muscle contraction, and blood coagulation, in addition to being a ubiquitous intracellular signal. Calcium is mainly absorbed in the duodenum. Calcium absorption from GI tract is regulated by vitamin D and parathyroid hormones. The serum level of calcium (Ca) is closely regulated with normal total calcium of 9-10.5 mg/dL (D. Fraser, G. Jones, S.W. Kooh and I. Raddle, 1994, M.J. Berridge, M.D. Bootman, H. L. Roderick. 2003, W.C Robertson and R.W. Marshakk, 1981. Magnesium is an intracellular cation. It is essential for enzyme activity, for the synthesis of nucleic acids and proteins, and has an important physiological role in the neuromuscular and cardiovascular systems. Total body magnesium is approximately 1000 mmols, of which 60% is in bone, 20% in skeletal muscle, and less than 1% in the extracellular fluid. In the circulation, 65% of serum magnesium is free (ionised), about 20% is protein bound, and the rest is complexed with various anions (eg: phosphate and citrate). The body magnesium balance is regulated by intestinal absorption (predominantly in the ileum and colon), and renal reabsorption (65-75% by the thick ascending loop of Henle, 15-20% in the proximal tubules). The most commonly used method for assessing magnesium status is serum magnesium concentration (H. Classen, 1984; R. Elin, S. Al-Ghamdi, E. Cameron, R. Sutton, 1994). Of the phosphorus in the body, 80% to 85% is found in the skeleton. In the extracellular fluid, including in serum, phosphorous is present mostly in the inorganic form. In serum, more than 85% of phosphorus is present as the free ion and less than 15% is protein-bound. Phosphorus also is an important component of phospholipids in cell membranes. The physiologic concentration of serum phosphorus (phosphate) in normal adults ranges from 2,5 to 4,5 mg/dL (0.80–1.44 mmol/L). Normal values range from 2,4 - 4,1 mg/dl (B. Kestenbaum, J. Sampson, K. Rudser, et al., 2005; G. Block, T. Hulbert-Shearon, N. Levin, et al., 1998; S. Silverberg, E. Shane, T. Clemens, et al., 1986).

This study was carried out in order to compare the differences of laboratory parameters related to bone metabolism such as alkaline phosphatase (ALP), serum calcium (Ca), magnesium (Mg) and phosphorus (P), in various sport branches.

Material and Methods

Serum alkaline phosphatase, calcium and phosphorus, and magnesium levels were measured in 23 skiers, 21 runners, 24 wrestlers, 20 handball, 21 soccers and 30 sedentary living healthy individual.

In the skiers (n=23), 5 subjects were females and 18 male (mean age: 22,3 ± 9,4, range: 19 – 25 years). In the runners (n=21), 4 subjects were females and 17 male (mean age: 25,1 ± 8,4, range: 18 – 26 years). In the wrestlers (n=24), 4 subjects were females and 20 male (mean age: 23,7± 9,1, range: 17 – 26 years). In the handball (n=20), 3 subjects were females and 17 male (mean age: 21,9 ± 7,4, range: 16 – 27 years). In the soccers (n=21), 5subjects were females and 16 male (mean age: 21.9 ± 8.9, range: 20–24 years).We also studied 22 healthy volunteers personnel (5 females and 17 males; mean age: 29.1 ± 11.8, range: 21 – 29 years).

The athletes and controls volunteered to participate in the study and gave their informed consent. None of the athletes and controls were under the treatment of whatever drugs. None of the patients were had any other chronic disease. All the controls were sedentary living healthy individual. Subjects were excluded if they had used any drug such as corticosteroid, methotrexate, etc., or had any disease or condition known to affect bone; had taken corticosteroid medications during the previous 6 months, had a history of chronic renal, hepatic, or gastrointestinal disease or traumatic lumbar compression fracture. Exclusion criteria included liver and kidney diseases, renal stones, diabetes, alcoholism, thyroid and parathyroid diseases hematological, lymph proliferative and other malignant diseases and drugs affecting bone mineral density such as anticonvulsants, corticosteroids, disease-modifying anti-rheumatic drugs (DMARDs), hormone replacement therapy (HRT), bisphosphonates, vitamin D, fluoride, calcitonin, calcium or thiazid group diuretics. Fasting blood samples of the study and control subjects were taken from the cubital vein and the parameters were examined by routine laboratory techniques. Serum ALP, Ca, Mg and Phosphorus were determined by using commercial autoanalyser

Data were processed using the SPSS 11,0 package programme. Laboratory results were given as mean ± standard deviation (SD). Differences between groups were analyzed using the Mann-Whitney U test. The Wilcoxon rank test was used to compare paired populations. Statistical significance level was set to 0.05 for all calculations.

Results

The groups were matched according to age and sex. As expected, there were no significant differences according to age or the female-male ratio between the athletes and controls subjects ($p>0.05$).

Serum alkaline phosphatase (ALP), serum calcium (Ca), magnesium (Mg) and phosphorus (P) were determined in the athletes and the healthy control subjects. In all the athletes and controls, routine biochemical parameters including alkaline phosphatase (ALP), serum calcium (Ca), magnesium (Mg) and phosphorus (P) were within normal limits **(Table 1).** The wrestlers had lower levels of calcium compared to control subjects **($p<0,05$).** The runners and handball had higher levels of phosphatase compared to control subjects **($P<0,05$).** Other parameters had no significant difference between athletes and controls (Table 2).

Discussion

Serum alkaline phosphatase is a mixture of isoenzymes contributed primarily by bone, liver, and intestine. Most data indicate that the elevation of serum ALP occurs because of the accelerated de novo synthesis of the enzyme and subsequent regurgitation into the serum (J. Reichling, M. Kaplan, 1967). Because of these contributions, serum alkaline phosphatase determination has been used to help distinguish between normal and disease states of these organs (G. Szasz, T. Hausamen, R. Helger, W. Rick and W. Gross, 1967). Age-and sex-related effects relative to serum alkaline phosphatase have been demonstrated by several investigators (SJ. Silverberg, 1997). There are non-significant differences in serum ALP concentrations between with all the different athletes and the control group. Because athlete groups aren't different from control group in respect of age and gender. However no body, who participated in this study including control group, has any disease which affects level of serum ALP. Calcium metabolism is complex, and other factors such as impaired liver and kidney function, poor nutritional status, and medications may act as confounding variables lowering calcium[17.] The present investigation reveals the net effect of these sport branches except for wrestlers group on serum calcium levels. In our study, serum levels of calcium were significantly lower only in the wrestlers group than the control group. The differences of the level or amount of daily diet may lead to low calcium level in wrestlers. Magnesium is an essential ion for many enzymatic reactions, especially those using high energy phosphate bounds (E. Ford, 1999). The low serum magnesium levels are associated with coronary heart disease (J. Ma, A. Folson, S. Melnick, J. Eckfeldt, A. Sharrett, A. Nabusi, R, Hutchinson, P. Metcalf, 1995), atherosclerosis- (PA Marken, CW.Weart, DS.Carson, JG. Gums, MF. Lopes-Virella, 1989) dyslipidemia (PA. Deuster and A. Singh, 1993.) As a metabolic cofactor, Mg is important in energy metabolism and glucose homeostasis[18.] The findings on serum magnesium concentration in these groups of patients were completely normal. In our study, there was not a significant rise in serum magnesium levels between in the athletes groups compared with the controls. The results are in total agreement with some previously published reports. Accumulating evidence has shown a direct relationship between magnesium and exercise performance. Some studies have reported that serum or plasma magnesium concentration was decreased after exercise(M. Laires and F. Alves, 1991; M. Levi, RE. Cronin, JP. Knochel,1992). No abnormal serum magnesium level has been found in any group including control group may be because they did not get exercise before the survey. The physiologic concentration of serum phosphorus (phosphate) in normal adults ranges from 2,5 to 4,5 mg/dL (0.80–1.44 mmol/L). A diurnal variation occurs in serum phosphorus of 0,6 to 1,0 mg/dL, the lowest concentration occurring between 8 AM and 11 AM. A seasonal variation also occurs; the highest serum phosphorus concentration is in the summer and the lowest in the winter. Major determinants of serum phosphorus concentration are dietary intake and gastrointestinal absorption of phosphorus, urinary excretion of phosphorus, and shifts between the intracellular and extracellular spaces. Abnormalities in any of these steps can result either in hypophosphatemia or hyperphosphatemia(K. Hruska, A. Gupta, 1998; JP. Knochel , R. Agarwal ,1996). In our study, there was also an alteration in serum phosphorus concentration in the groups with runners and handball. Potassium, the level of diurnal, has been measured as normal especially in healthy sedentary group. This can be explained by the fact that it was winter afternoon when the blood samples were received.

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