



The Influence of Tae Bo Exercises On The Value of Phosphorus And Calcium In Women With Osteoporosis

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Introduction

Bones are metabolically active organs. Their remodeling is essential for the proper functioning of the bone system during bone growth and reconstruction, fracture healing, and maintenance of calcium and phosphorus homeostasis. Bone metabolism and tissue properties are affected by trace elements that can act indirectly by regulating macromineral metabolism, or directly by affecting the proliferation or activity of osteoblasts and osteoclasts, or by becoming part of the bone mineral matrix [1].

Blood calcium and phosphorus levels are tightly controlled within a very narrow range due to calcium-phosphate homeostasis, which is the basis for the functioning of all types of cells in the body. Calcium and phosphorus are necessary for the functioning of striated skeletal muscles and heart muscle cells, as well as for neuronal and neuromuscular activity [2]. Homeostatic control of these two elements is also important for physical activity and sports performance. Homeostasis of calcium and phosphorus is maintained by the regulation of entrance gates (intestines), exit gates (kidneys) and storage (skeleton). The regulatory signal is generated by parathyroid hormone (PTH) and other hormones [3].

Loss of calcium from bones during periods of inactivity is mostly caused by protein loss in the bone matrix, which is associated with protein loss in other parts of the body, especially muscles (Theethira et al., 2014).

In recent years, numerous studies have shown remarkably consistent results regarding the beneficial effects of exercise on bone mineral density (BMD) of the lumbar spine and femur in menopausal women and in the elderly in general. In addition to maintaining bone mineral density, physical activity in the elderly is important because it increases muscle strength and improves balance, which can prevent falls [4]. Various exercises are described to stimulate bone growth and maintain bone mass. The best interventions are those that mechanically stimulate the bones through antigravity loading and stress exerted on the muscles [5].

Tae Bo is precisely a form of high-intensity aerobic training that combines the techniques of aerobic dance (Latin dance, hip-hop dance and ballet) and the Far Eastern sports of Tae Kwon Do, karate and boxing accompanied by music [6]. Tae Bo is an acronym for Total Awareness Excellent Body Obedience developed by American taekwondo player Billy Blanks in the late 1980s [7]. It is one of the first cardio boxing programs in the world and complements existing aerobic dance exercises. This form of exercise provides an alternative and variety of movements, and the main purpose is commitment, increasing awareness of oneself and the world around one, and striving for excellence in everyday life (Tekin et al., 2018). Tae-bo exercises improve metabolism and the muscular system, affect coordination, balance and flexibility [8]. In addition, this type of training ensures the loss of 500-800

calories as a result of a 60-minute training and is therefore more effective than traditional aerobic training, during which 300-400 calories can be burned (Turgut and Metin, 2019). Janković et al. [8] in their research showed that Tae Bo exercises have a positive effect on bone building indicators and the quality of life of people with osteoporosis and can be used as therapeutic exercises because they are well accepted by patients.

Some studies have shown that strenuous exercise can cause calcium loss, while moderate exercise increases bone mass (Theethira et al., 2014). The aim of this research was to show the influence of Tae Bo exercises and walking on calcium and phosphorus values in women suffering from osteoporosis.

Materials and Methods

The research was designed as a prospective randomized

control study. 92 women with a diagnosis of osteoporosis between the ages of 55 and 65 took part in the study. At the beginning and at the end of the study, blood, urine and densitometry laboratory tests were performed, as well as ten-year fracture risk assessment questionnaires (FRAX) and the QUALEFFO 31 quality of life questionnaire. The test subjects were divided into two groups, whereby 46 test subjects performed Tae Bo exercises three times a week for 45 minutes, and the other 46 test subjects walked three times a week for 45 minutes. The research lasted 6 months. The SPSS for Windows software package (version 20.0, SPSS Inc, Chicago, Illinois, USA) and Microsoft Excel (version 10, Microsoft Corporation, Redmond, WA, USA) were used for statistical data analysis. For continuous variables, the symmetry of their distribution was first analyzed using the Shapiro-Wilk test, while the median and interquartile range were used to display the mean value and measures of dispersion.

Results and Discussion

Table: 1

Age group of A			
Group A	BMI	Age	Menopausa
number	46		
mediu value	25,0	60,6	6,7
max	32,8	66,0	10,0
min	19,7		2,0
st.dev.	3,45	3,44	1,87
coefficient of asymmetry	0,73	0,06	-0,46
confinement coefficient	-0,24	-1,47	-0,25
Age of women of group B			
Group B	BMI	Age	Menopause
number	46		
mediu value	27,5	60,8	6,5
max	39,0	66,0	10,0
min	20,9	56,0	2,0
st.dev.	3,99	3,17	2,16
coefficient of asymmetry	0,72	-0,07	-0,79
confinement coefficient	0,51	-1,40	-0,08

Exercise is beneficial for bone health and is recommended for the prevention and treatment of low bone mineral density (BMD). However, lower BMD has been observed in endurance athletes, including cyclists and runners, in some studies [9].

Significant declines in hip and lumbar spine BMD were observed in road cyclists studied over a year of training and competition. The annual decline of 1% to 2% is similar to the accelerated bone loss that occurs in early postmenopausal women [10].

These findings support the idea that, in some cases, intense exercise can lead to bone mineral loss. The mechanism by which exercise causes loss of BMD is not yet fully understood. If serum ionized calcium (iCa) levels decrease during exercise, this would be expected to lead to an increase in parathyroid hormone (PTH),

which acts by increasing calcium absorption, decreasing renal excretion, and mobilizing skeletal calcium (ie, increasing bone resorption) [11].

Phosphorus is an important element that participates in bone structure. Its reference values for men and women range from 0.79-1.42 mmol/L. (can't find the reference). Phosphorus is the second, next to calcium, basic constituent of bone tissue. Due to its mobility, it is a key human intracellular anion, which participates in maintaining acid-base balance in the body, creating buffer systems in blood and urine [12].

It is a mineral that the body uses in the production of proteins that participate in the construction and recovery of cells and tissues. Among its many roles, phosphorus control is extremely

important in the conduction of nerve impulses, as well as how it affects carbohydrate metabolism [1]. For the purposes of this paper, initial and final blood phosphorus values for groups A and B were determined by laboratory blood analysis (Table 2, Table 4.).

Table 2: Initial and final phosphorus values in women who practiced Tae Bo (group A).

Group A	Phosphorus		
	initial	final	change
number	46		
media value	1,18	1,15	-0,03
max	1,44	1,41	0,28
min	0,79	0,97	-0,34
st.dev.	0,15	0,12	0,12
coefficient of asymmetry	-0,24	0,36	-0,30
confinement coefficient	-0,35	-0,46	0,73
p-value of change T-score			0,409

Analyzing the data of the subjects of group A, we can see how the initial phosphorus values range from a minimum of 0.79 mmol/L to a maximum of 1.44 mmol/L, the mean value of phosphorus concentration in the blood is 1.18 mmol/L, with a standard deviation of 0.15. At the end of the research, analyzing the level of phosphorus in the blood of the subjects of group A, it can be seen that the final phosphorus values are again at a minimum of 0.79 mmol/L, while the maximum phosphorus values at the end of the research are 1.41 mmol/L; the mean value of group A is 1.15 mmol/L, with a standard deviation of 0.12. Comparing the initial and final phosphorus values for group A, it can be seen that statistically ("p" value of 0.409) the change in phosphorus values is not significant, although the lower limit (minimum value within the group) jumped from 0.8 to 1.0 and with what the width of the measured interval decreased by more than 30%.

Calcium is an element that is important for the construction of our bones and teeth, and as such, about 99% is present in bones. For diagnostic and treatment purposes, its concentrations in blood and urine are determined [13].

Calcium intake determines its retention in bones during bone growth and thus contributes to peak bone mass in early adulthood. Its intake is an important predictor of total body bone mass. Insufficient calcium intake during growth can negatively affect skeletal maturity, predisposing to osteoporotic fractures later in life (Zhu and Prince, 2012).

For the purposes of this paper, laboratory blood analysis determined the initial and final blood calcium values for both groups (Table 3, Table 5), and its reference values for men and women are from 2.14 mmol/L to 2.53 mmol/L.

Table 3: Calcium values of group A at the beginning and at the end of the study in women who practiced Tae Bo (group A).

Group A	Calcium		
	inital	final	change
number	46		
media value	2,37	2,37	0,01
max	2,71	2,72	0,30
min	2,12	2,17	-0,23
st.dev.	0,15	0,14	0,09
coefficient of asymmetry	-0,02	0,20	0,56
confinement coefficient	-0,77	-0,95	2,90
p-value of change T-score			0,476

Analyzing the data, it can be seen that at the beginning of the study, the subjects of group A had a minimum calcium value of 2.12 mol/L; a maximum of 2.71 mmol/L, while the mean value of the initial calcium level for group A was 2.37 mmol/L with a standard deviation of 0.15. At the end of the research, the minimum calcium values are 2.17 mmol/L to the maximum 2.37 mmol/L, and the mean value is equal to the mean value of group A at the beginning

of the study and is 2.37 mmol/L. The only difference is that the standard deviation has decreased to 0.14. By comparing the initial and final calcium values, it can be noted that the "p" value is 0.476 and as such does not represent a statistically significant difference. The improvement in the further limit ("min") from 2.12 to 2.17 is statistically insignificant.

Table 4: Initial and final phosphorus values in women who did not practice Tae Bo (group B).

Group B	Phosphorus		
	initial	final	Change
number	46		
media value	1,2	1,2	0,00
max	1,4	1,4	0,20
min	1,0	1,0	-0,24
st.dev.	0,13	0,11	0,09
coefficient of asymmetry	-0,23	-0,15	-0,67
confinement coefficient	-0,70	-0,54	1,88
p-value of change T-score			0,481

Analyzing the initial values of phosphorus from the blood of group B can see how the minimum values of phosphorus concentration are 1.0 mmol/L to the maximum 1.4 mmol/L, and the mean value of the group is 1.2 mmol/L with a standard deviation of 0.13. At the end of the research, a laboratory analysis of the phosphorus of the subjects of group B was carried out, and it can be seen from table 4 that the minimum, maximum values and the mean value are equal to those at the beginning of the research, but the standard deviation has changed and at the end of the research it is 0.11. The value of the change “p” of the initial and final results is 0.481 and as such does not show statistical significance, however,

comparing the result “p” of the values of groups A and B, it can be noticed that there is a marginally lower value for the subjects of group A.

According to the results achieved, it can be concluded that in this research the phosphorus values, which were within the normal range for most of the test subjects, are not necessarily a valuable indicator of bone formation or bone breakdown. However, as noted earlier, the phosphorus values of the two subjects with lower values at the beginning of the study (less than 1.0) in group A increased. From a statistical point of view, a sample of 2 is insignificant.

Table 5: Initial and final calcium values in women who did not practice Tae Bo (group B).

Group B	Calcium		
	initial	final	Change
number	46		
media value	2,3	2,3	-0,02
max	2,5	2,5	0,11
min	2,1	2,1	-0,21
st.dev.	0,14	0,11	0,08
coefficient of asymmetry	0,15	0,47	-0,60
confinement coefficient	-1,27	-0,95	-0,12
p-value of change T-score			0,408

Analyzing the initial blood calcium values of the subjects of group B, we see that they range from a minimum of 2.1 mmol/L to a maximum of 2.5 mmol/L, and the mean value of the group is 2.3 mmol/L, with a standard deviation of 0.14. The final laboratory findings confirmed that the concentration of calcium in the blood did not change in the minimum, maximum and mean values compared to the initial values of group B, while the standard deviation was lower than 0.11. As with the “p” value of phosphorus, the “p” value of calcium of group B, which is 0.408, is not statistically significant.

Findings

Although there were no statistically significant changes in the level of calcium and phosphorus in this study, it is necessary to monitor them in people suffering from osteoporosis. In addition

to the consumption of calcium therapy with supplementation with other vitamins and minerals, especially vitamin D, it is necessary to include exercise in the prevention and treatment of osteoporosis. Tae Bo exercises can be an excellent choice for the mentioned ailments because they can be adapted depending on the needs of an individual or a group. Also, the results of this research show that there was no drop in the level of calcium and phosphorus, which indicates that Tae Bo, although it is a highly intensive aerobic training, is safe for people suffering from osteoporosis if it is performed by a professionally trained physiotherapist.

Acknowledgement

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Conflict of Interest

No conflict of Interest.

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