Iranian Journal of Health and Physical Activity (2011) 2 (1), 57-61

The Comparison of Serum Calcium, Phosphorus, Parathormone, Calcitonine, Alkaline Phosphatase and Acid Phosphatase in Active and Inactive Menopause Women

Mohammad Reza RamezanPour [1], Mohammad Reza Hamedinia [2], Fatemeh Vaeznia [3]

[1]*Mashhad Branch, Islamic Azad University, Mashhad, Iran*
[2]*Tarbiat Moalem University, Sabzevar,Iran*
[3]*Ms in Physical Education Sport Sciences*

Received 17 September 2010 Accepted 22 December 2010

Abstract

Objective: Sport mechanical stresses are effective stimuli for strengthening bone tissue. By the beginning of Menopause, assimilation of bone tissue increases. The object of this study was to compare some bone and Calsium metabolism indices in active and inactive Menopause women (MW). For this purpose, urinary and serum Calcium and Phosphorus, Alkaline Phosphatase (AP), Acid Phosphatase and Parathormone and Calcitonine hormone (CH) were measured.

Method: 14 MW who had an experience in sport, in Sabsevar sport clubs, were taken as active group and 14 MW who used to go to park of Mellat as leisure were chosen as the inactive group. There were no significant differences between two groups in height, age of menopause, weight, BMI and body fat percentage. Also, for the sake of accurate comparison, other variables such as: blood pressure, rest heart rate, WHR and Vo2max were measured .Subjects did not take any specific drugs. 80 cc of second morning urine and 10 ml of vein blood were taken from subjects before the breakfast. In order for the data comparison of two groups, t-student test was used.

Results: 1- Serum calcium rate, serum Parathormone and bone AP in active MW were significantly lower than inactive women, and CH rate in active MW was significantly higher than inactive women ($p<0.05$). 2- There were no significant differences between urine calcium, serum and urine Phosphorus, Resisted Acid Phosphatase to serum Tartarate and between Calcium ration to urine creatinin, among active MW and inactive women.

Conclusion: It seems that prolonged regular physical activity can influence calcium and bone metabolism indices in MW and prevent bone degeneration, and with the reduction of Parathormone and the increase of CH, the bone tissue is prevented from losing calcium and other minerals**.**

Keywords: Calcium, Alkaline Phosphates, Acid Phosphates, Calcitonine, Menopause women

Introduction

In 1991, the World Health Organization introduced osteoporosis, heart attack, cerebral apoplexy, and cancer as the four major enemies of humanities and asked the world to begin fighting them. The studies conducted by Iran Rheumatology Center showed the mineral density of bones in normal people was lower than the standards of Halogic system [1, 2]. Reduction of bone density has no evident external symptom and progresses so much that the bones are fractured with the smallest pressure [3, 4, and 5]. Until now, there has been no effective therapy for preventing this reduction of bone density in menopausal women. Although the Anti-receptions process tends to slow down the decline of bone density, it has no bone making activity. Hormone replacement therapy also slows down the decline of bone density; however, there is substantial evidence that it also increases the risk of strokes, cardiovascular diseases, and breast cancer, tending to weaken its advantages against osteoporosis in menopausal women [5, 6, 7 and 8]. Indices of bone metabolism may be used to diagnose bone diseases, slow down bone decline, prevent future fractures or assess the effects of anti-absorption therapy (9, 4 and 10). Research indicates that mechanical stress during sport activities is a good stimulus for effective bone making in all age groups. Since most active women tend to reduce their activities as they age, they may use some light exercises to maintain their level of activity at the bone making margin during their menopausal life [11].

Bone is a dynamic tissue adapting to the weight

∗ Coresponding author E-mail:
Ramz45@yahoo.com

applied to it [8]. This bone tissue suffers a higher rate of decline during menopause [11]. Since change in bone tissues occurs at a slow pace we cannot demonstrate bone dynamics only through measurement of mineral bone density [12]. Given the effect of exercise on the bone density of menopausal women, most studies report the effects of physical activity on biochemical indices of bone metabolism. Bone absorption and production indices enable us to assess bone changes in response to mechanical stress [13, 14]. Weight exercises affect bone metabolism and biochemical bone indices are used to assess the effects of these mechanisms. Bone production indices such as "osteocalcin or alkaline phosphatase" or absorption indices such as "dioxipyridinoline or tartrate-resistant phosphatase acid" reflect bone changes. Studying parathyroid density, which has both productive and reductive effects on bones and increases during different exercise, provides more information [12]. There is no sufficient information about the influences of mechanical stress on bone metabolism and the effects of physical activity on bone mechanisms of menopausal women are yet to be determined [15].

Changes in lifestyle and decreased physical activity are among the causes of increased rates of thigh bone fracture in the past 30 years. Recently, other than the hormone replacement therapy, much attention has been focused on physical exercise and calcium supplements [16]. Regular physical activity may be effective in the treatment of bone density reduction. Regular physical activities has no sort of side effects, has low costs, and is associated with other advantages such as body strength and prevention of falling [14]. Although the positive effect of exercising on bone mass is quite known, results of all studies do not go in the same direction. Some studies indicate walking at the aerobic margin and weight exercises tend to reduce serum and urinary osteocalcin. This is while other studies have shown that aerobic and anaerobic exercises increase serum levels of osteocalcin, or that fast walking has no great effect on bone indices. Thorson (1996) and Yamazaki (2004) showed that average intense walking in menopausal women had a minor positive effect on bone metabolism [15]. While there was a weak relationship between regular physical activity and reduced bone density decline [17]. Regular daily physical activity reduced urinary disposal of bone absorption indices. He argued that having regular physical activities is essential for prevention of bone absorption from increasing during menopause. There was little relationship between regular physical activities and maximum oxygen consumption with bone metabolism indices in menopausal women. But regular walking by menopausal women for 2 years failed to make any change in their bone indices, yet indices related to absorption were increased in the inactive group [8]. Studies conducted on the relationship between the effects of physical activities and bone metabolism indices are different in terms of findings and conclusion. Despite the lack of harmony among results, it is possible that physical activities have positive effects on bone masses of menopausal women and may, in effect, prevent bone absorption or reduce urinary calcium disposal. Given the possible benefits of exercise and physical activity on bone and calcium metabolism in menopausal women, it seems necessary to pay more attention to such studies and topics. The positive effects of physical activity on slowing down bone decline process have made researchers interested in the effects of physical activities on bone metabolism. Thus, the question is posed whether or not having an active lifestyle and indulging in regular exercise and physical activity is effective on the bone decline process, or whether menopausal women having regular physical activities are different from inactive menopausal women in terms of bone decline. In other words, they want to see if calcium and bone metabolism indices are different among active and inactive menopausal women.

This study was aimed at comparing some bone and calcium metabolism indices between active and inactive menopausal women. Indices such as urinary calcium and phosphorus, serum creatinine, calcium and phosphorus, as well as bone-specific alkaline phosphatase were taken as the indexes of bone production, tartrate-resistant phosphatase acid as the index of bone absorption and parathyroid and calcitonin hormones were measured for the comparison of calcium and bone metabolism between the two groups.

Materials and Methods:

This study was of descriptive-scientific-comparative post-occurrence type.

Statistical Population: It included menopausal women of the ages of 50-60 from Sabzevar city.

Statistical Sample: 28 menopausal women (active group = 14, inactive group =14).

Sampling Method: Active samples were taken from among menopausal women attending sport clubs in Sabzevar city; they had at least one year of regular physical activity. There were 350 menopausal women in about 17 official clubs, 74 of which expressed willingness to participate in our tests by filling the questionnaires. Among the 25 people qualified to take part in our study 14 were chosen by a simple random method.

Inactive samples were taken from among middle aged women going to public parks and places and were willing to participate in the tests. From among 40 people qualified to take part according to their physiologic factors, 14 were taken by random. The samples were arranged so that each inactive and active pair were similar in terms of age, menopause age, height, weight, body mass index (BMI), waist to hip ratio (WHR) and body fat percent.

Independent Variables: menopause, regular physical activity.

Dependent Variables:

1. Serum and urinary calcium,
2. Urinary calcium to creatinine ratio,
3. Serum and urinary phosphor,
4. Urinary phosphor to creatinine ration,
5. Serum bone-specific alkaline phosphatase content,
6. Srum tartrate-resistant phosphatase acid,
7. Serum parathyroid and calcitonin hormone levels.

Controlled Variables: Age, height, weight, menopause age, maximum aerobic power, working power capacity, BMI, WHR, fat percent, blood pressure, physical activity and the food taken in two days prior to running the tests.

Measurement Instruments:

1. Soehnle-Medica medical balance, made in Germany,
2. Seca height measuring instrument, made in Germany,
3. Biospace body composition analyzer, made in Korea,
4. Ateye Ergo Meter bicycle, EC1600, made in Japan,
5. Braun digital blood pressure measurement tool, made in Germany,
6. 5-channel gama counter gentis, made in USA,
7. RA-100 auto analyzer, made in USA,
8. Awareness statfay 2100, made in USA,
9. Centrifuge machine made by Behdad Company of Iran.

Methods of Collecting Urinary and Serum Samples: Test subjects were asked to be fasting for 12 hours and be present at the lab at 9:00 a.m. First, 80 cc of second morning urine sample was taken and then 10 ml of blood sample was taken from arm vain in resting stance. Blood samples were left at room temperature for 15 minutes to coagulate. They were then centrifuged for 10 minutes at a speed of 800 rpm. The resulting serum was kept at -70°C until the analysis time.

Statistical Methods

1- To describe the data we used mean value, standard deviation, and change percent.

2- We used Student t-test for independent groups to study the differences between variables of the two groups, and to study the relationship between the variables we used Pearson's moment correlation at an alpha level of 0.05.

Results:

Once the data were analyzed it was found that:

1- The rate of serum calcium, serum parathyroid hormone, and serum alkaline phosphatase in active menopausal women was significantly lower than inactive menopausal women, and the rate of calcitonin in active menopausal women was significantly higher than inactive ones ($P<0.05$).

2- There was no significant difference between urinary calcium, serum phosphor, urinary phosphor, serum tartrate-resistant phosphatase acid, and urinary calcium to creatinine ratio in active and inactive menopausal women (Table 1).

Discussion and Conclusion

Test subjects of the two groups were similar in terms of variables such as weight, height, BMI, WHR, fat percent, menopause age. But active samples were significantly higher than inactive ones in variables such as maximum aerobic power ($P=0.0001$) and working power capacity ($P=0.001$). But variables such as systolic and diastolic blood pressure and resting heart beat showed no difference between the groups. The differences were significant for some indices such as serum calcium ($P=0.02$), serum bone-specific alkaline phosphatase ($P=0.004$), parathyroid ($P=0.027$) and calcitonin ($P=0.025$) hormones.

Serum calcium index of active menopausal women was significantly lower than inactive women, yet according to mean and standard deviations, (8.56±0.44 for active group, 9.31±0.7 for inactive group) values of both groups were in the natural range of serum calcium. This findings are in agreement with those findings [15, 19]. But was been reported increased serum calcium due to physical activity, observed no significant change in serum calcium [20].

Urinary calcium index with creatinine correction was not significantly different in active and inactive menopausal women, though the urinary calcium with creatinine in the active group was 26.89% higher than the inactive group. Yet the two values were inside the normal range of urinary calcium given the means and standard deviations (0.93±0.03

Table 1: Comparison of Variables in Active and Inactive Menopausal Women

Variables	Groups	Mean±SD	Change * Percent	t	P
Serum calcium (mg/dl)	Active	8.56±0.44	-1.12	3.35	0.002
	Inactive	9.31±0.70			
Urinary calcium (mg/dl)	Active	8.78±3.84	+26.65	1.6	0.12
	Inactive	6.44±-0.88			
Urinary Calcium to creatinine ratio	Active	0.93±0.03	+26.89	1.5	0.12
	Inactive	0.68±0.05			
Serum phosphor (mg/dl)	Active	4.09±0.33	-1.21	0.44	0.66
	Inactive	4.14±0.35			
Urinary phosphor (mg/dl)	Active	36.53±15.22	+0.69	0.04	0.96
	Inactive	36.28±16.02			
Serum bone-specific alkaline phosphatase (IU/I)	Active	199.71±23.5	-14.45	2.3	0.004
	Inactive	233.43±31.5			
Serum phosphatase acid (IU/I)	Active	3.72±1.50	-22.5	1.5	0.12
	Inactive	4.80±2.09			
Serum parathyroid hormone (pmol/l)	Active	23.0±3.70	-18.27	2.38	0.027
	Inactive	28.14±7.30			
Serum calcitonin hormone (pg/ml)	Active	3.23±1.26	+33.44	38.2	0.025
	Inactive	2.15±1.14			

* Change of variables between active and inactive groups

for active group, 0.68±0.05 for inactive group). This finding is in line with some researches [21, 22].

There was no significant difference observed in the serum phosphor of active and inactive menopausal women. The values of both groups were inside the normal range according to means and standard deviations (4.09±0.33 for active, 4.14±0.35 for inactive). This finding is in agreement [20]. Also there was no significant difference in the urinary phosphor indices of the two groups and the values were inside normal range (36.53±15.22 for active and 36.28±16.02 for inactive group). This finding was in line with [21], but was reported increased urinary phosphor due to physical activities [3].

Serum bone alkaline phosphatase in active menopausal women was significantly lower than inactive women. The values of both groups were inside normal range (199.71±23.49 for active, 233.43±31.51 for inactive group). This finding matches with [18, 22]. Yet some researchers have reported no significant change [12, 15, and 20]. Many researchers have reported increased serum phosphatase [16, 21].

Tartarate-resistant phosphatase acid, which is the index for bone destruction, showed no significant difference between active and inactive menopausal women (P=0.12). The value is inside the normal range for both groups (3.72±150 for active and 4.80±2.09 for inactive group). Though the difference is not significance, Tartarate-resistant phosphatase acid was 22.5% higher in the inactive group than the active group. These findings were in line with [8, 14] but some researchers reported a reduction of phosphatase acid due to physical activities [12, 20, 22].

Parathyroid hormone index of active menopausal women was significantly higher than the inactive group, being inside the normal range (23.0±3.70 for active and 28.1±7.30 for inactive groups). The finding matches with [8, 19] But some researchers reported no significant difference; even some of them reported a reduction [15, 20].

Calcitonin in active menopausal women was significantly higher than inactive women. The values were inside the normal range (3.23±1.26 for active and 2.15±1.14 for inactive groups) according to mean values and standard deviations. The finding matches with Thorson [15].

According to the findings of this study, the indices for making and destruction of bones in inactive menopausal women were higher than active women. Also, serum parathyroid of inactive menopausal women was higher than active ones, while serum calcitonin was more in the active group rather than the inactive. Then, serum calcium was higher in the inactive group. It also seemed that bone metabolism of inactive menopausal women was higher than active women. These findings accord with those Iwamoto, Ashizawa and Yamazaki [18, 20, 22]. But other researchers reported increased bone metabolism (making and destruction indices), e.g. Thorson [15]. Some researchers said they did not observe any significant change in bone making and destruction indices due to physical activity [15, 20].

Some researchers only reported the increased bone production index due to physical activity, including Grimes and Sarah [7, 10]. Some others only reported the decrease of absorption index, including Murph and Ashizawa [14, 22]. Another group reported that physical activity causes an increase in bone production and destruction indices Iwamoto [20]. This difference may be due to the type of exercise, duration, intensity, test subject, measurement method, or different production and destruction indices. Though it seems that the effect of one session of physical activity (endurance or power) or short term exercises might have more acute effects on bone regeneration and increase of indices [4, 15, 16]. In studies taking exercises for about one year bone regeneration was decreased [7, 11, and 12]. It seems physical activity affects the indices in two ways: long-term effect results in bone regeneration and short-time acute effect results in increased bone production and absorption indices [15].

Overall Conclusion: According to the results it seems regular and long-time physical activity may influence the indices related to bone metabolism and menopausal women calcium rates or prevent bone decline by reducing bone regeneration. It can also reduce parathyroid hormone and increase calcitonin to prevent bone tissues made of calcium and minerals. Although, most studies report the positive effects of exercise in decreasing bone tissues, the effects of exercise on biochemical bone indices are not easy to assess [3, 6, 9] and results of studies conducted on women before and after menopause are contradictory at best [5, 17,18]. Future studies may provide better answers to our questions.

References

1. Writer's Group for the women's Health Initiative. (2002). Risks and benefits of estrogen plus progestin in healthy postmenopausal women. J American Medical Association 288: 1-26.
2. Soleimani, Saleh Abadi .(2002). Role of Exercise and Change of Lifestyle in Prevention and Treatment of Osteoporosis. Andishmand Publications, Tehran: 413-421.
3. Albright F, Burnett C, H, & Cope O, et al. (1941) .Acute atrophy of bone (osteoporosis) simulating hyper paratthyoidism. Jclin Endocrinol Metab 1:11-16.
4. Howe, Kathleen S. (2004). Exercise Therapy as treatment for postmenopausal osteoporosis in women not currently talking Hormone replacement therapy. Major Department Exercise and sport Sciences.
5. Alloya J. (1994). Osteoporosis: Methods of Prevention and Treatment. Shahram Farajzadeh, Elm-o-Harkat Publications.
6. Bravo G, Gauthier P, Roy PM, Payette H, Gaulin P, Harvey M, Peloguin L and Dubois MF. (1996). Impact of a 12-month exercise program on the physical and psychological health of osteopenic women. J Am Geratr soc 44(7): 756-62.
7. Grimes DA & Lobo RA. (2002). Perspectives on the women's health initiative trial of hormone replacement therapy. J obstetrics and Gynecology.100: 1344-53.
8. Tobias JH & compstion JE (1999). Dese estrogen stimulate osteoblast function in postmentopausal women? J Bone 24(2): 121-124.
9. Majkic SN, Ilic M, Ignjatovic S & Aleksandera PG. (2002). Assessment of four biochemical makers of bone Metabolism in postmenopausal osteoporosis. Jelin lab 48 (7-8): 407-13.
10. Sarah, M. (2001). Osteopenic bone diseases. In-koopman w (ed) Arthridis and allied condition, phila-delphia-Lippincott Williams and witkins. 2472.
11. Pouilles JM, Tremollieres F & Ribot C.(1994). Effect of menopause on vertebral bone mass. A longitudinal study. J presse Med 23 (23): 1069-73.
12. Remes T, Valsanen SB, Mahonen A, Huuskonen J, Kroger H, Jurvelin JS, Penttila KM & Raurama R. (2004). The association concentrations, and regular exercise in middle-agedmen. J Bone 35(2): 439-447.
13. Koike T. (2002). Effect of exercise as a therapy for osteoporosis on bone metabolism. J clin calcium 12(4): 461-6.
14. Murph NM, Carroll P. (2003). The effect of physical activity and its interaction with nutrition on bone health. J proc Nutr soc 62(4): 829-38.
15. Thorsen k & lorentzon. (1996). The Effect of Brisk walking on Markers of Bone and Calcium Metabolism in postmenopausal women. J caleiftissue int 58:221-225.
16. Vincent KR & Braith RW. (2002). Resistance exercise and bone turnover in elderly men and women. J Med Sci sport Exerc 34(1): 17-23.
17. Ernst E. (1998). Exercise for female osteporosis . A systematic review of randomized clinical trials. J Sport Med 25(6): 359-68.
18. Yamazaki I, Iwamoto T & Toyama. (2004). Effect of walking exercise on bone metabolism in postmenopausal women with osteopenia /osteoporosis . J Bone miner Metab 22:500-508.
19. Maimoun L, Simar D, Malatesta D, Caillaud C, Peruchon E, Couret I, et al.(2005). Response of bone metabolism related hormones to a single session of strenuous exercise in active elderly subjects. Br J Sports Med 39: 497-502.
20. Iwamoto J, Takeda T, Ichimua S.(2001). Effect of exercise training and detraining on bone mineral density in postmenopausal women with osteoprosis. J Orthop Sci 6: 128-32.
21. Ghaeeni S.(1995). Examination and comparison of urine calcium and phosphorous in active and inactive elderlies [dissertation]. Tehran: Tehran University: 15-17.
22. Ashizawa N, Fujimura R, Tokuyama K, Suzuki M.(1997). A bout of resistance exercise increases urinary calcium independently of osteoclastic activation in men. J Appl Physiol 83: 1159-63.