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Effects of Aerobic Versus Strengthening Exercises on Improvement of Balance, Bone Density and Quality of Life in Post Menopausal Women with Osteoporosis

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Abstract

Objectives: Osteoporosis is the most common metabolic bone disease. The aim of this study was to investigate the effects of exercise therapy on balance, bone density and life quality in women with primary osteoporosis and to compare two types of aerobic and strengthening exercises on improving the mentioned indexes. *Methods*: In this randomized controlled trial, 90 postmenopausal women with osteoporosis during an 18- month period were randomized into three groups of 30 people. All groups received mineral supplementation and anti bone loss medications. In second and third groups, aerobic and strengthening exercises were conducted for 9 months. Balance parameters including falling risk and postural instability of Biodex instrument and clinical measure of "timed up and go" (TUG) were determined. Bone mineral density (BMD) of lumbar and femoral regions was measured by Densitometry. Quality of life was determined by SF36 questionnaire. *Results*: Although average BMD was significantly increased in all groups, mean of this increase in BMD of lumbar and femoral areas had no statistically significant difference among three groups (0.29 ± 0.19, 0.26 ± 0.25, 0.26±0.23, P=0.834). Significant recovery was noted in reduction of postural instability and TUG in two exercise groups, but with better improvement for aerobic team. Improving life quality has been demonstrated in all groups. *Conclusions*: Performing coherent 9-month exercise program in post menopause women increases strength, maintain balance and improve life quality compared to the women under medication alone. A subtle increase in bone density was observed among three groups without distinct difference, effects of which seems to be stronger by long-term exercise. Therefore combination of aerobic and strengthening exercises along with medication is recommended in this spectrum of patients.

Keywords

Osteoporosis, Postmenopausal Women, Bone Mineral Density, Aerobic Exercises, Strengthening Exercises

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1. Introduction

Osteoporosis is the most common metabolic bone disease and it is considered as a global health issue. According to World Health Organization (WHO), osteoporosis is defined as skeletal structure changes as loss of bone mineral density 2.5 standard deviations below the peak mean bone mass of young normal adults [1]. The main complication of osteoporosis, which is more common in post menopausal

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women, is fractures in vertebral column and pelvis; however these fractures are probable in every part of the skeletal system.

More than 10 million people suffer from osteoporosis in the United States from whom only very few people are diagnosed and treated [2]. Osteoporosis has been reported to have a prevalence of 32.4% in the lumbar spine and 5.9% in femur in 60 to 69 year old Iranian females. According to this research, although peak bone mass in Iranian adults is lower than European or American population, the rate of bone loss is equal in both eastern and western societies [3, 4].

Despite of this fact that some studies demonstrated estrogen replacement associated with exercise therapy is more effective than calcium diet combined with exercise in increasing bone density, however side effects of hormone therapy should also borne in mind [5]. Many researchers confirmed the positive effect of exercise on balance and preventing from fall in the females with osteoporosis [6]. Overall exercise can increase bone formation and decrease bone loss, so the main objective of physical activities in patients with osteoporosis is to reduce the incidence of fall and fracture [7, 8].

On the other hand in the majority of studies, the style of exercise, vigor, duration, continuation or frequency and types of sports therapy are different and debatable, as a result more research on this topic needs to be undertaken [9].

Kemmler et al. in the several researches confirmed the positive effects of exercise on balance keeping, muscle force increasing, bone density and lifestyle improvements in one-year and two- year schedules and even demonstrated high anti-fracture efficiency of multipurpose exercise programs after 16-year long term follow up [10-13].

Considering the above-mentioned items, the importance of the subject and lack of any similar study in our society especially about comparing of different exercise therapies, we decided to carry out a comprehensive study evaluating effects of two types of aerobic and strengthening exercises among females with primary osteoporosis focusing on three major objectives: 1) evaluation of balance status 2) measurement of bone density in lumbar and femoral neck regions, and 3) determining of life quality in the study groups as well as intergroup comparison regarding the efficacy of interventions on each of above indices.

2. Methods and Materials

2.1. Study Design and Participants

This randomized controlled trial was conducted between April 2012 and October 2013 during an 18- month period. All eligible patients were selected from Physical Medicine and Rehabilitation or Rheumatology outpatient clinics of Tabriz University of Medical Sciences at first screening.

A total of 90 post menopausal females diagnosed with severe osteopenia and osteoporosis during a9-month period were assessed at baseline and randomly assigned into three groups A, B, and C including two sports therapy groups and one control group via lottery method. Inclusion criteria were: females with severe osteopenia with -2.5<T-score<-1.5 and osteoporosis with T score ≤ -2.5 as well as patients' willingness to participate in this study.

Exclusion criteria were: severe cardiovascular disease, severe skeletal disabilities, severe inflammatory or degenerative joint disorders restricting weight-bearing exercises and also physical activities except the cases presented during the study in both sports groups. These three groups were homogeneous regarding demographic specifications such as age, height, weight and history of different diseases. Later on, medical therapy was initiated for all three groups including Alendronate 70 mg weekly associated with calcium daily 1000 mg and vitamin D daily 800 units. In addition to medication different types of exercises were performed in groups 2 and 3.

2.2. Balance Assessment

Balance measurements were performed using "Biodex balance system SD" [manufactured by Biodex Medical Systems Company, USA], an equipment tool for balance testing and training. Two indices of fall risk and postural stability were utilized to evaluate balance status. Postural stability is a proportional scale which explores the patients sway envelopes and measures the range of body posture deviation from central gravity point. Fall risk also is an index which determines risk of falls in a proportional scale and shows that how many times it has increased in a scoring format based on the age range of the patients. Accordingly, test results were compared to age and gender dependent normative values.

Clinical balance examination including timed up and go test "TUG" was also performed in all three groups. The TUG measures the time it takes a subject to stand up from an armchair, walk a distance of 3 m, turning around an obstacle, walk back the same distance to the chair, and sit down. The unit of this scale is in seconds which was being calculated by a chronometer. "TUG" is indicative of balance function and muscle coordination and has been proposed its use as a short test of mobility skills for frail elderly [14]. Based on the age range of the patients (50 to 99 years), the normal time of this test varies from 7.1 to 12.7 seconds. Of course this elapsed time is higher in females [15].

2.3. Bone Mineral Density Measurement

Dual-energy X-ray absorptiometry (DXA, previously DEXA) is a means of measuring bone mineral density (BMD). Baseline BMD was defined for all patients and bone densitometry was performed using Bone Densitometer [Dual Energy-Hologic- QDR-4500 Elite USA] device in this survey.

In this method T-score (bone density ratio compared to peak mean bone mass of young normal adults) was determined as well as Z-score. Z-score is the number of standard deviations from the mean bone density for age-matched, sex matched, and ethnic matched individuals. BMD in gr/cm^2 and BMC (bone mineral content) in gr were identified. In according WHO definitions; T-score greater than -1 is interpreted as normal bone, T-score between -1 and -2.5 as osteopenia and T-score less than -2.5 is defined as osteoporosis [1]. Bone densitometry was performed by a densitometry technician and reported by a specialist. Technical points regarding validity of the device especially patient position and defining the required area for densitometry were born in mind. Quality assurance and phantom spine were done for the device daily throughout the study.

2.4. Quality of Life Assessment

SF36 health survey questionnaire composed of 8 health concepts of general, social, emotional and psychological health, physical function and bodily pain of the patients, which has been translated in a simple Persian language, was given to the patients to be filled before and after treatment. In each subgroup, all questions are scored on a scale from 0 to 100, with 100 representing the highest level of functioning possible. Aggregate scores are computed as a percentage of the total points possible; using the RAND scoring table [16]. It is noteworthy that validity and reliability of this questionnaire has been investigated, so that this quality of life questionnaire is valid and reliable for patients in our community.

2.5. Exercise Program

Exercise schedule was performed as the following in each group in Physical Medicine and Rehabilitation outpatient ward of Madani Hospital under the supervision of a physician and experienced physiotherapist.

In the second group aerobic exercises were performed in three sessions; namely warm-up (10 minutes) by an instructor and teaching through a video, which was followed by weight-bearing exercises including running on treadmill with 60% to 80% maximal heart rate and cycling on a stationary ergo-meter for 30 minutes and then cooling down for five minutes and finally relaxation and stretching. In the third group strengthening exercises were performed for extensor muscles of the trunk, hip abductor and knee extensor muscles. These training programs consisted of isometric exercises followed by isotonic exercises using resistance band or theraband and cuff weights for hip abductors and Quader table with free weights for knee extensors and progressive McKenzie extension type exercises for trunk and back extensors.

It should be mentioned that exercises were performed in 10 or 15 people groups three days a week for a total nine months with a relative rest period of one month every two months. In other words, our sports therapy program was overally included six month exercise associated with three months home-based exercise schedule within therapy periods. Home-based exercises consisted of40 min walking or biking 3 times a week for group 2 and strengthening exercises which as above mentioned for group 3.

After nine months, the above assessments including muscle force measurements, balance and bone densitometry were repeated in all three groups and test results of each patient were recorded in the data collection form in each group before and after intervention. It should be mentioned that patients were categorized by a physiotherapist. The examiner or physical medicine specialist was unaware of patients grouping.

It should be noticed that written consent was obtained from all patients before the study and this research was approved by regional ethics committee of Tabriz University of Medical Sciences. It has also been registered in Iranian clinical trials site with number IRCT201008153217N2.

2.6. Statistical Analysis

All the data were analyzed using SPSS statistical package version 18.0 for Windows. The mean values and frequencies of the parameters were assessed by descriptive statistical methods [frequency, percentage and mean ± standard deviation). Paired *t*. test was used for comparing the mean of the quantitative variables before and after intervention within each group and independent *t*-test was used to compare the mean of the variables between two groups. One way ANOVA test was utilized to compare the mean variation of the variables between the groups and in case of its being significant, to compare three groups two by two, Post Hoc-Tukey test was used to discover where the inequality has taken place. The confidence interval was set at 95% and $P<0.05$ was accepted to be statistically significant. Normal distribution of data was investigated by Kolmogorov-Smirnov test and the correlation between quantitative variables was defined using Pearson correlation coefficient.

3. Results

3.1. Baseline Characteristics

Ninety women met the inclusion criteria and enrolled in the

trial. The characteristic of patients were similar between three groups regarding age [55.90 ± .80 vs. 56.40 ± 6.80 vs. 59.00 ± 7.31, P = 0.080), weight [68.61 ± 8.11 vs. 66.16 ± 10.35 vs. 71.66 ± 13.82kg, P=0.459) and height [157.13 ± 4.60 vs. 160.03 ± 6.03 vs. 158.13 ± 5.09 P=0.309) in aerobic, strengthening and control groups, respectively. Therefore no significant difference was observed between the patients of all three groups regarding age, height and weight. These baseline characteristics and other variables are presented in table 1.

Table 1. Baseline demographic data and characteristics of variables among three studied groups' participants.

Variables	Aerobic exercise group (n=30)	Strengthening exercise group (n=30)	Control group without exercise (n=30)	P-value[e]
Age(years)	55.90± .80[a]	55.40± 6.80	59.00± 7.31	0.08
Weight(kg)	67.61± 8.11	64.16± 10.35	66.66± 13.82	0.45
Height (cm)	156.13± 4.60	154.03± 6.03	155.13± 5.09	0.30
BMI[b] (kg/m^2)	27.81± 3.83	26.97± 3.59	27.62± 5.34	0.73
TUG[c]	15.25±2.18	14.31±1.60	15.58±2.51	0.06
Fall risk	3.08±0.98	2.75±1.13	3.59±1.53	0.61
Postural stability	1.31±0.60	1.13±0.48	1.24±0.64	0.06
Lumbar BMD[d]	-2.51±0.75	-2.54±1.11	-2.93±1.01	0.05
femoral BMD	-1.86±0.76	-1.58±0.76	-1.94±0.83	0.08
Total score of SF 36 questionnaire	52.66 ± 15.01	50.39 ± 10.19	52.35 ± 12.36	0.75

[a] Values are shown as mean ± Standard deviation
[b] BMI: Body Mass Index, [c] TUG: Timed Up & Go, [d] BMD: bone mineral density, which was measured by T-score, obtained through DXA (dual-energy X-ray absorptiometry), [e]*P*>0.05, shows no significant difference between groups (ANOVA test)

Measured mean parameters as well as quality of life score before and after nine months treatment in all three groups are demonstrated in table 2.

3.2. Balance Status Evaluation

The mean of the changes or variations of timed up and go variable was -0.25±0.86 in the group without exercise, -2.62±1.30 in the group with aerobic exercises and -1.71±1.04 in the group with strengthening exercises which indicates that the time needed for doing the exercise reduces as speed of walking excels. There is a significant difference between three groups regarding improvements ratio (df=2, F= 36.2 and P<0.001) and between the group without exercise and two groups with exercise (P<0.001). Group with aerobic exercises also demonstrated a significant difference compared to the strengthening exercise group (P= 0.005).

The mean of the changes for fall risk and postural stability indexes were also analyzed in the same way and are presented in the table 3.

3.3. Bone Mineral Density Measurement

The mean of the changes or the difference between before and after intervention for lumbar BMD variable was 0.26±0.23 in the group without exercise, 0.26±0.25 in the group with aerobic exercises and 0.29±0.19 in the group with strengthening exercises which indicates an increase of bone density in the lumbar region in all three groups (P=0.030 and P<0.001, see table 2).

Table 2. Comparison of variables and their changes within each group at baseline and after 9-month follow up.

Variables	Aerobic exercise group (n=30)			Strengthening exercise Group (n=30)			Control group without exercise (n=30)		
	Before	After	P value[d]	Before	After	P value	Before	After	P value
TUG [a]	15.25 (2.18)[b]	12.63 (1.90)	<0.001	14.31 (1.60)	13.05 (1.45)	<0.001	15.58 (2.51)	15.28 (2.30)	0.107
Fall risk	3.08 (0.98)	1.91 (0.89)	<0.001	2.75 (1.13)	2.18 (0.75)	<0.001	3.59 (1.53)	3.61 (1.50)	0.613
Postural stability	1.31 (0.60)	0.82 (0.56)	<0.001	1.13 (0.48)	0.83 (0.49)	<0.001	1.24 (0.64)	1.19 (0.63)	0.062
Lumbar BMD [c]	-2.51 (0.75)	-2.27 (0.72)	<0.001	-2.54 (1.11)	-2.38 (0.61)	0.030	-2.93 (1.01)	-2.86 (0.87)	<0.001
Femoral BMD	-1.86 (0.76)	-1.74 (0.72)	0.003	-1.58 (0.76)	-1.40 (0.64)	<0.001	-1.94 (0.83)	-1.67 (0.98)	0.084
Total score of SF 36 questionnaire	52.66 (15.01)	70.55 (7.2)	<0.001	50.39 (10.19)	68.11 (9.5)	<0.001	52.35 (12.36)	61.03 (9.2)	0.02

[a] TUG: Time Up & Go
[b] Values are shown as mean (standard deviation)
[c] BMD: bone mineral density, which was measured by T-score, was obtained *via* DXA(dual energy X-ray absorptiometry)
[d] P<0.05, shows significant changes within the group (paired sample *t* test)

These improvements ratio in lumbar bone density revealed no statistically significant difference between three studied groups (df=2, F= 0.182 and P= 0.834) and also in comparing two groups with and without exercise (P= 0.999 and 0.849). In addition aerobic exercises and strengthening exercises had no preference over each other regarding increase in this variable (P= 0.873).

Femoral neck BMD was increased significantly in both exercise groups compared to baseline (p<0.001), but this difference was not considerable in control group (p= 0.084). The mean changes of femoral BMD also analyzed in the same way and are shown in the table 3. Again aerobic and strengthening exercises had no preference over each other regarding increase in this variable (P = 0.945).

Comparisons of mean changes between all variables before and after intervention among three studied groups are summarized in table 3. As well as the range of changes in lumbar and femoral BMD are shown in figure 1.

Table 3. Comparison of the mean changes (after-before intervention) of the variables between three studied groups two by two.

	Group					
Variable	**Aerobic exercise (group A, n=30)**	**Strengthening exercise (group B, n=30)**	**Control without exercise (group C, n=30)**	**P_V(A-C)b**	**P_V(B-C)**	**P_V(A-B)**
Time up & go	-2.62±1.30[a]	-1.74±1.04	-0.25±0.86	P<0.001	P<0.001	0.005
Fall Risk	-0.81±0.39	-0.62±0.56	-0.14±0.21	P<0.001	P<0.001	0.166
Postural Stability	-0.49±0.39	-0.30±0.26	-0.05±0.14	P<0.001	P<0.003	0.027
Lumbar BMD[c]	0.26±25	0.29±0.19	0.26±0.23	0.999	0.849	0.873
Femoral BMD	0.15±0.19	0.17±0.20	0.12±0.20	0.889	0.714	0.945
Quadriceps strength	0.66±0.95	1.13±0.89	0.00±0.45	0.005	P<0.001	0.069
Hip abductors strength	1.16±1.39	0.96±0.92	0.20±0.40	P<0.001	0.010	0.717
Total score of SF36questionnaire	17.83±11.14	18.39±8.85	8.68± 4.96	P<0.001	P<0.001	0.967

[a] mean of changes(after-before intervention) ± SD

[b] *P*<0.05, is considered significant difference between groups (Post Hoc Tukey test)

[c] BMD: bone mineral density, which was measured by T-score, obtained through DXA(dual-energy X-ray absorptiometry).

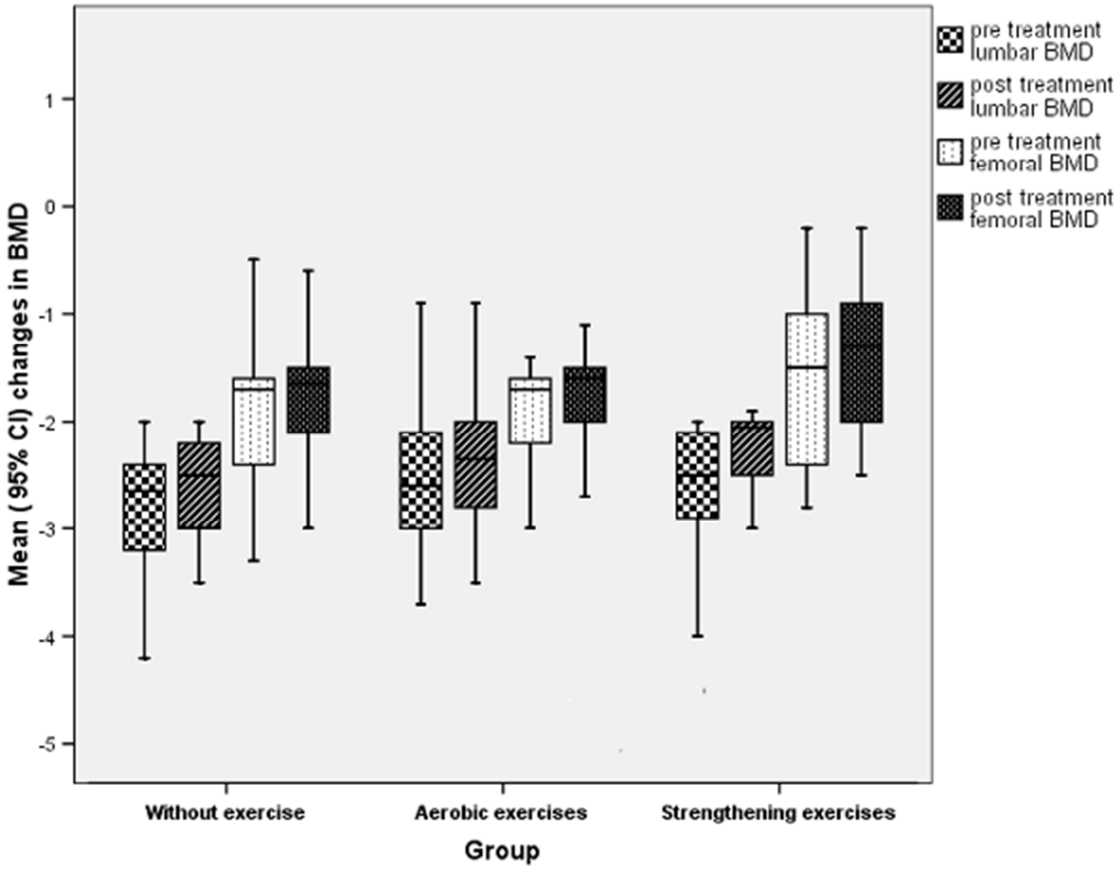

Figure 1. Mean changes in the BMD of lumbar spine and femoral neck regions over the 9-month study period.

4. Discussion

The results obtained from this study revealed that in the intra group comparison before and after intervention, the mean BMD significantly increased in all three groups (except for neck of femur BMD in the group without exercise), however, there was no statistically significant difference between three groups as well as in the comparison of two different exercise groups regarding the mean of bone density increase in lumbar and femoral regions after treatment.

In this regard, Kemmler and colleagues (2002-2015) carried out numerous studies in the EFOPS (Erlangen Fitness Osteoporosis Prevention Study) center in Germany, which all confirmed that increase in bone density of lumbar vertebrae, increase in VO_2 max and maximal isometric muscle force after a one-year study, increase in femoral bone density, decrease in lipid profile and improvement in quality of life after a two-year study were significantly different compared to the control group [10-13, 17-18].

Final results of Kemmler et al. showed that eventually BMD after long term follow up decreased in both groups; however, the reduction was more pronounced in the control group. This study clearly evidenced the high anti-fracture efficiency of diverse exercise programs. Therefore, they strongly encourage older adults to perform multipurpose exercise programs [13].

In another study by the same researcher and Engelke et al., almost similar results were obtained. In this study two different exercise groups were compared with control group (without exercise). One group was given low volume high resistance training and the other group was given high impact aerobic exercise. After carrying out a three-year schedule ,it was revealed that there were pain reduction and BMD increase in vertebral column, hip and heel with no changes in forearm in both exercise groups associated with no difference between two groups and even deterioration of the variables in the control group [17].

Some points should be highlighted regarding these studies: *firstly*, high impact and high intensity exercises, either aerobic or resistance trainings are more effective in increasing bone density compared with low intensity exercises. Some related studies have suggested that intermittent high-impact/high-intensity resistance protocols to be performed at least twice per week. Although, in the frail elderly, high-frequency/high-cycle number exercise programs with low-to-moderate intensity may also positively affect bone strength [18].

Secondly, to gain these positive effects longer periods of time (more than one year) are required, that is to say continuous and constant exercise increases BMD and improves other parameters compared to the group without exercise and any discontinuance in the exercise schedule would probably deprive us from its benefits. This fact could be observed in our study similarly, therefore it can be concluded that in the case of continuing exercise schedule within more than one year additional effects on bone density will be observed.

Thirdly, these exercise effects are mostly site-specific; therefore BMD did not improve significantly in the forearm region, as specific upper limb exercises were not performed. Respectively in our study also strengthening exercises focusing on trunk and knee extensor and hip abductor muscles had more effect on muscle force in these regions compared to aerobic exercises, which mostly act globally instead of specific muscles group.

And *fourthly*, there was no significant difference between two exercise groups (aerobic and strengthening exercises) regarding improvements in majority of variables. In fact a combination of both aerobic and resistance training exercises is recommended in osteoporosis which is much alike to the results of our study.

Based on the results of Suominen et al. athletes who are active in the field of power events including weightlifting and hurdling have more bone mass with a stronger structure compared to the athletes from other fields in all age ranges. It seems that the effect of exercise is more dominant in the period of growth more than other periods in life as the gain obtained from BMC as well as BMD is estimated to be almost 2-5 percent per year, whereas the gain obtained from exercise on BMD is less in elderly people and is about 1-3 percent per year [19].

Resistance training exercises are more practical, have site-specific effects and act specifically on the sites which have undergone more stress and physical activities. These types of exercises maintain or improve bone density, reduce fall risk, are safe and can be performed easily among elderly [19].

In this regard, the results of study performed by Subirats et al., concerning exercise prescription and dosage, demonstrated that benefits of aerobic exercise are obtained through moderate intensity exercise for at least 30 minutes 5 days per week or vigorous exercise for at least 20 minutes 3days a week. It is also recommended to add 8-10 exercises that develop the strength of most muscle groups (arms, shoulders, abdomen, back, hips and legs). These authors concluded that the exercise may involve musculoskeletal injuries and cardiovascular risk, but the benefit outweighs the risk [20].

Systematic review of numerous studies revealed that PRE (Progressive Resistive Exercise) weight lifting and CKC

(Closed Kinetic Chain) weight training within one year increased BMD in the vertebral column and hip region and maintained bone density 12 months later. So they finally recommended that these exercises should be performed lifelong [21, 22].

It should be borne in mind that aerobic exercises of our study were mostly weight-bearing type, in contrast strengthening exercises were mostly non-weight-bearing and the resistance utilized in these exercises had low to moderate intensity. Strengthening exercises in our study was performed using theraband and quad table; hence PRE with weightlifting was not used in our protocol. Therefore the method and type of exercises and the load utilized are different from each other in these studies. Stengel and Kemmler in other research confirmed above findings and suggested that power training (fast movements) is more effective than strength training (slow movements) in reducing bone loss in postmenopausal women [23].

Regarding balanced status, obtained results of our study revealed a significant difference in both exercise groups compared to the group without exercise, which shows improvements in walking time or agility in performing timed up and go test, fall risk reduction and postural stability. It should be mentioned that TUG and postural stability indexes presented more improvements in aerobic exercises group compared to the other two groups.

It seems that aerobic exercise protocols in our study, which mostly focus on fast walking on treadmill, are associated with more weight-bearing and axial stress and consequently have more effect on postural stability compared to the strengthening exercise schedule, which includes isometric and isotonic exercises of back extensor, quadriceps and hip muscles. As a result aerobic exercises by gradual increase in speed and inclination of the treadmill, increase the efficiency of the patient in doing the activities which require agility and muscle coordination and finally these exercises decrease function time in TUG tests.

The results of other study revealed that a home-based exercise schedule with a minimum supervision in post-menopause females with a single vertebral fracture after12 months in spite of improving life quality and balance tests, had no positive effect on TUG of the patients and femoral and lumbar BMD compared to the control group [24]. It is likely that in this home-based exercise schedule, vigour and duration of the exercise to affect above-mentioned parameters have not been adequate.

Hourigan et al. showed that balance training exercises concomitant exercises enhancing trunk muscles strength for 20 weeks, can considerably improve balance and muscle force and decrease fall risk in the females with osteopenia. Changes in densitometry, in spite of being positive, were not statistically significant which can be due to this fact that prolonged procedure of bone remodelling is needed for increasing BMD [25]. These findings are in consistent with our study.

However one of the researches carried out by Niuet al. revealed that femoral neck BMD increased in high impact exercise (HIE) group versus reduction in stretching exercise group in post-menopause females after one year schedule [26]. One reason is partly related to this fact that the time needed for increasing of femur BMD was sufficient in this study. Another reason is related to style of exercise, which was high impact/high intensity not low to moderate intensity, as above mentioned, HIE more affects on increasing bone density. Of course, it should be noted that performing high intensity exercises should be avoided in osteoporotic patients and who have fragile bones. These exercises are mostly allowed in osteopenic patients or postmenopausal women with low-normal BMD [1].

Life quality improvement was evaluated using SF36 questionnaire. Regarding the majority of subscales in this questionnaire, it should be mentioned that there was a statistically significant difference in all three groups before and after intervention. Significant difference was also noted in the comparison of the groups with and without exercise regarding the improvements in mean score of physical function, physical health, social activities, psychological and emotional role functioning. However no significant difference was observed in comparing two different exercise groups.

In similar studies, it has also been detected performing home based exercise and balance training once a week for one year, causes a statistically significant increase in quality of life and decrease in fall risk of osteoporotic females in post-menopause period compared to control group [27, 28].

These results indicate that effects of exercise accompanied by medication on social, psychological and physical health is more dominant than effects of drug therapy alone.

Overall the results obtained from present and other studies show that exercise mostly affects psychological health indexes and psychosomatic signs of the patients. In other words, sports therapy and group activities improve the motivation of patients in participating in exercise programs which consequently results in improvement of daily activities.

Finally one of the limitations of this study was the follow-up period being short which needs more time regarding the impact of exercise on each of above-mentioned indices specially bone density. Therefore continuing this study associated with long term follow-up exercise schedule after one year and two years is suggested.

5. Conclusions

This study indicated that performing a coherent six-month exercise program combined with three months home-based schedule in post-menopause females increases muscle force, maintains better balance keeping and improves quality of life in this group of patients compared to the group of females who were under medications alone in their post-menopause period. A subtle but considerable increase in bone density was observed among exercise and non-exercise groups without any distinct difference, effects of which seems to be stronger by long-term and continuous exercise program. Therefore a combination of aerobic and strengthening exercises along with medication is recommended for treatment in this spectrum of women.

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