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EFFECT OF PHYSICAL THERAPY INTERVENTIONS ON BONE MINERAL DENSITY, MUSCLE STRENGTH AND QUALITY OF LIFE IN WOMEN WITH OSTEOPOROSIS, SYSTEMATIC REVIEW AND META ANALYZE

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ABSTRACT

Introduction and objective: Osteoporosis is a most common metabolic bone disease that increase the risk of bone fracture by creating a structural abnormality in the bone. Osteoporosis is a common disease among middle-age and older persons, especially women. Therefore, the necessity of implementing strategic plans to prevent osteoporosis is significantly important. Osteoporosis in women has been reported as a risk factor for health and reduced bone mineral density in the elderly. The study was designed to determine the Effect of physical therapy interventions on bone mineral density, muscle strength and quality of life in women with osteoporosis.
Material and Methods: This systematic review study was done among 3488 article referred to subject research of osteoporosis and physical therapies in reducing osteoporosis risk among patients women with osteoporosis, in August 1950 to August 2016 by search Keywords : prediction of osteoporosis, physical therapy and osteoporosis. date of search was at day 19 january 2017. The quality of the included studies was assessed by the PeDro score.
Results: a total of 6 randomised controlled trials involving 397 patients were identified. The mean PeDro score was 8. The pooled standardised mean difference for strength training = 0.4346 (95% CI: 0.2135–0.60, P = 0.01 < 0.00001, P for heterogeneity = 0.85, I2 = 0%). While pooled results for osteoporosis risk outcomes in, strength training, showed a significant reduction in reduced risk of osteoporosis significantly.
Conclusion: Results of This systematic review study showed that physical therapies training improved risk of osteoporosis in older women with osteoporosis.

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Introduction

Osteoporosis is defined as a progressive bony disease is characterized by low bone mass, bone fragility and risk of fracture [1]. Increased risk of fracture, followed by high rates of morbidity and mortality associated with osteoporosis worldwide the biggest concern is health [2, 3]. Osteoporosis is divided into two types: primary and secondary. Primary osteoporosis, type 1

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due to low levels of estrogen in women can be seen [4]. Primary osteoporosis, type 2 is expressed as osteoporosis associated with aging that in both genders and more than 75 years with a 2: 1 ratio in women than men is seen [4]. Secondary osteoporosis in men and women with an equal proportion in each age is observed [4]. Therefore, women are facing with an increased risk of osteoporosis [4]. On the other hand, in this regard, during menopause and with increasing age, the relationship between the amount of bone re-absorption Followed by bone formation is disrupted that this provides change at the end of each cycle reconstruction and prevalence of osteoporosis in women than in men [4].

Further research has shown that women with osteoporosis are more likely to fracture if these people fall [5]. Risk factors for falls include factors such as: impaired balance, abnormal patterns of gait [6, 7] ،muscle weakness[8] And postural disorders such as hyper-kyphotic posture [9, 10, 11-13]. Hyper-kyphotic posture most common form of postural changes with age in patients with osteoporosis has been considered [14]. Hyper-kyphotic posture provides ground for physical disability, vertebral fractures and mortality in patients with osteoporosis [15-18]. Vertebral, hip and distal radius fractures has increased with low bone mass after menopause in women [19]. This suggests that osteoporosis is different complications such as: Pain, gradual reduction of height, hyper kyphosis, disability, osteoporotic bone fractures, vertebral deformity and loss of bone mass [20-23]. In addition, a sedentary lifestyle, could lead to decreased bone mass, muscle weakness, postural defects, physical disability and finally osteoporosis [19, 24, 25]. On the other hand, physical activity may have a major role in preventing osteoporosis [26].

Exercise in people with osteoporosis may decrease fracture risk by maintaining bone mass and most importantly by improving postural stability and balance and thereby reducing the failure rate [27]. The optimal type, duration and frequency of such exercises is not specified [28,29]. Training programs for women with osteoporosis are designed risk factors for falls and increasing the mechanical loading that includes resistance training and weight-bearing exercises [30]. A meta-analysis study has shown that aerobic and resistance exercises has led to 1% to 2% of the beneficial effects in the control group by slowing the loss of bone density [31-35]. Other types of exercise programs in elderly adults with osteoporosis has been used, including aquatic exercise [36]. On the other hand a literature review on the effects of hydrotherapy in older people found improvement in pain, function, muscle strength and balance in the group of aquatic exercises than non exercise group [37]. In a study conducted by nick d.carter and colleagues reported a osteofit program for 20 weeks has improved, knee extension strength, balance and quality of life in a great community osteoporotic women aged 65-75 years [5]. On the other hand, in a study conducted by Zainab S Motorwala and colleagues stated that yoga exercises have been introduced as a popular treatment for menopausal women with osteoporosis to counteract the negative effects, yoga exercises stimulates the bones to maintain calcium, this can be done through weight-bearing in Yoga exercises [4]. Therefore, this exercises resulted in improvements in BMD, quality of life, balance, muscle strength and flexibility [38-40]. On the other hand, in a RCT study conducted by Ivan Bautmans and colleagues reported that the implementation of a rehabilitation program for thoracic spine including hand mobilization, taping and postural corrective exercises, has led to improvement in severe thoracic kyphosis, back pain and quality of life in postmenopausal women with osteoporosis[18].

According to the our information, yet no study has studied systematically review the effect of physiotherapy interventions in general on the variables of bone mineral density, muscle strength and quality of life in women with osteoporosis with age greater than or equal to 30 years for prevention and treatment. Therefore the purpose of our study is to assess the strength of eligible articles that have examined the effect of physical therapy interventions on bone mineral density, muscle strength and quality of life in women with osteoporosis. We selected RCT or Quasi RCT articles that have examined the effect of physiotherapy interventions on bone mineral density, muscle strength and quality of life in women with osteoporosis. This systematic review study is significant because this study provides for doctors and physiotherapists according to previous studies an appropriate therapeutic intervention based on evidence for women with osteoporosis at age greater than or equal to 30 years.

Method:

Criteria for considering studies for this systematic review:

Study questions is made based on Pico participants, intervention, comparisons, outcomes and study design). We selected studies that were RCT and quasi randomised trials that were published in English. In all the studies, gender was female and age range (greater than or equal to 30 years) with osteoporosis and osteoporosis in different areas of the body. The t-score of bone densitometry must score (t-score less than or equal -2.5) related to osteoporosis and osteopenia is not. The t-score them according to the World Health Organization (who) are different and can also be used in the treatment and prevention in age greater than or equal to 30 years, they used to be osteoporosis studies in different areas of the body and not just in one area. The only studies that physical therapy interventions have not combined with others in a group to investigate the treatment effect used and other groups to compare other treatments with physiotherapy interventions should be used, other treatments not combined with physiotherapy interventions to be assessed the independent effect of physical therapy interventions and with these characteristics this is a strength sign of these studies. Therefore, studies that physical therapy interventions with other forms of treatment such as drugs, analgesics, hormone therapy, diet therapy, surgery and Calcium have used in this study don't involve. Other treatment forms of physical therapy interventions have used too. The authors of this study are considered all physical therapy interventions. In studies Bone mineral density (BMD), as one of the variables not BMC or bone mineral

content and bone metabolic parameters, muscle strength nor muscle power and quality of life no physical function or function were included. In the study were considered in 2016 was measured BMD using dual energy x-ray absorptiometry (DEXA), in the 1996 study using single photon absorptiometry bmd index, in the 2002 study muscle strength by dynamometry and quality of life using osteoporosis specific health-related quality of life questionnaire, in 2008 study quality of life using a questionnaire QOL that includes five sections and each item is the score 1-7, in the 2001 study knee extension strength are measured using dynamometry, and in another study in 2010 quality of life through qualeffo-41 questionnaire a questionnaire which has been adjusted for patients with osteoporosis and consists of 5 sections and total score of 0-100 that the higher scores are worse measured quality of life indicators. Studies that were published between 1996 -2016 are considered.

Search methods for identification of studies:
We selected articles that are just RCT of websites including pubmed, cochrane library, science of direct and between August 1950 and August 2016 in the English language and search using the key words physiotherapy and osteoporosis has been, Disagreement was resolved by consent or consultation with a third person.

Data Collection and analysis :
We've got a list of articles according to search for related articles according to the abstract and title, then we selected full text articles are available only. An author evaluated title and abstract based on the input criteria. Another author has assessed eligible RCT articles according to the criteria disagreement was resolved by consultation with a third person. We contacted with authors for full-text articles if necessary. Information independently extracted by a pair of authors and is used from a information extraction form before the test. In case of disagreement, the issue has been resolved.
To evaluate the quality of the methodology, we used Pedro scale that 11 item to be included [41]. More items from 6, added that including: the method of recruitment, study location, intervention, objectives, measuring instruments for variables, sample size to assess quality of included studies. Meta-analysis are examined the effects of physical interventions on BMD, muscular strength, quality of life, have used analysis revman5.2. Changes in BMD, muscular strength, quality of life. Heterogeneity of the selected studies was tested using I^2 statistic. The difference in change scores between the intervention group and the control group were estimated and divided by the pooled standard deviation using the random effects model. All differences in the mean data using the standard mean difference (SMD) and with a safety factor CI: 95% was estimated.

Results:
Primary research was included about 3488, of these about 719 free full text articles is available, and the remaining articles was available only their abstracts, more articles were rejected for reasons such as: title, abstract, repetitive articles and other reasons (review papers, non-RCT papers and unrelated to our analysis). On the other hand, papers that including: interventions expect for physiotherapy interventions, physical therapy in combination with other interventions such as: calcium or drug, the dependent variable is bone mineral content (BMC) or changes in metabolic bone instead of variable of BMD, the use of function or physical function instead of quality of life, the population is osteopenia, sex is combination of man and woman, age less than 30 years and article language is not English were excluded. Finally, six articles have inclusion criterias for our study .

Participants
A total of 397 people were participated in the six studies .Included studies were RCT and were published between 1950 and 2016. Age should be greater than or equal to 30 years. All participants had osteoporosis also t-score should be less than or equal to 2.5 according to the World Health Organization. The sample size in six studies were considered between 30 to 92 that mean sample size was 66.16. Interventions were performed in Brussels [18], Canada [30], Australia [42], british [5, 43], India [4].

Intervention:
In eligible studies, intervention and follow up period was between 10 weeks to 4 years. These studies have been included many physiotherapy interventions including: osteofit exercises based on community in two studies (includes strength training and balance), aquatic exercises versus land [30), yoga exercises [4), rehabilitation comprehensive program including: manual mobilization, taping and postural corrective exercises[18) and routine exercise therapy including:1) moderate warm ups, 2) stretching for improvement of flexibility, 3) improving of postural stability, motor control, coordination and muscle strength[18, 42]. In these studies, Measurement instruments included such: dynamometry to measure the strength of knee extension, dual energy x-ray absorptiometry(DEXA) and single photon absorptiometry to measure the bone mineral density, osteoporosis specific health-related quality of life questionnaire, quality of life questionnaire (QOLQ) and Qualeffo-41 questionnaire to measure the quality of life.

Methodological quality assessment:

Supplementary data available in muscular Strength and The effect of physiotherapy interventions on quality of life in women with osteoporosis online. The mean PEDro score for all studies was 8, indicating high-quality RCTs were selected, high quality of trial design, with intention-to-treat analysis and allocation concealment would improve the quality of the RCTs as well as reduce potential biases.

Intervention effects:

Bone mineral density (BMD):

2 of the 6 studies showed that significantly selected interventions has improved BMD in women with osteoporosis. One study has shown that yoga exercises has led to improved BMD by improvements in lumbar spine BMD t-score of 0.17 ± -2.69 at baseline to 0.25 ±- 2.55 after exercise that in this study, paired t-test was used to analyze the effects before and after exercise while the dual energy x-ray absorptiometry (DEXA) is used to measure BMD that the exercises had been used for 6 months. In a study conducted by elisabeth preisinger and his colleagues have shown that routine exercise therapy has led to a significant reduction in the patient's forearm BMD in the intervention group 2 and the control group 3, while no significant change was reported in the intervention group 1 that these exercises was used for a long time and 4 years, also in this study the forearm bone density was measured using single photon absorptiometry [42].

Muscular Strength:

2 of the 6 studies have shown that selected intervention significantly improved muscle strength in women with osteoporosis. A study conducted by Nick D.Carter and his colleagues reported that osteofit training program based-community including a community - based strength and balance training programme osteofit has led to improvement but insignificant in knee extension strength in intervention group (CI 95% , -5.4%- 21.5% %،mean difference7.8) in women 65-75 years old with osteoporosis for 20 weeks and measured by dynamometer, also improvement in knee extension strength was greater in the intervention group compared to the control group after adjustment of physical activity, perception and the number of fractures ($p = 0.047$) [5].

In another study, by carter and his colleagues have shown that osteofit training incuding: strength training and balance exercises has led to improvement in knee extension strength in the intervention group 13.9 (7.3)% For less than 10 weeks of studies have been done to improve knee ext strength in the exercise group 13.9 (7.3)% and a decrease in the control group 0.2 (7.3)% which is measured by dynamometer and has lasted for 10 weeks [43].

Quality of life:

3 of the 6 studies have shown that the selected interventions have improved quality of life in women with osteoporosis. The effect of osteofit exercises on quality of life has shown that there was no difference intergroup in total score of quality of life for a long time of 20 weeks while in this study, quality of life was measured by osteoporosis specific health-related quality of life questionnere of the European foundation for osteoporosis, also mean changes in quality of life domain has been for control group ((2.37 -2.98)-0.31) and for intervention group ((2.37 -3.00)-0.48) with CI 95% and P>0.05 after adjusting for age, medical services, physical activity and years of use of estrogen that shows intergroup differences was insignificant [44-46 ,5]. Aquatic training exercises in the land that has been used for 20 weeks showed no difference in the quality of life in women with osteoporosis, The application aquatic exercise (ae) or land exercise (le) have followed in comparison with non exercise (ne) or no control The least significant difference test and post-hoc, significant differences were found between groups in such a way that ae and le le larger improvement than there ae.

So the quality of life by op qol questionnaire (oqolq) has been measured that contains 5 items And any item from the 1-7 range, was ranked the higher scores are better qol signs so that oqol emotion for the group ae5.8 (102) to 6.0 (1.1) for group le5.9 (1.1) 6.0 (1.3) and for ne5.9 (1.1) to 6.1 (1.0), $f2,83 = 0.18$, univariate results $p = 0.84$, observed power = 0.08 has been estimated In a study conducted by ivan bautmans and colleagues rehabilitation program includes mobilization hand, taping and postural correction exercise was carried out for 3 months, And the effect of this intervention on mental health perception of quality of life items quietly but significantly ($p = 0.029$) in the group rehabilitation than the control group worsened So that the total score quality of life at baseline and after 3 months of therapy (3.7 ± 38.0 to 3.6 ± 37.8) and in the control group at baseline and after 3 months of (3.5 ± 36.6 to 3.8 ± 34.4) has been changed pvalue = 0.560 While qol by qualeffo-41 A special questionnaire for op [44, 45] which consists of 5 items that measured the overall score on a scale of 0-100, which become higher scores indicating worse is qol [18].

Meta-analysis of outcome measures :

It seems that the effect of physical therapy interventions on quality of life in women with osteoporosis were more effective than other items.

Meta-analysis of study outcomes were possible in finding out of the total selected studies.. In three of the six selected study, variable of quality of life has improved. So that the effect of an exercise intervention group (0.74- to 0.85), with ci 95% and $p \leq 0.05$, which represents the difference between groups was significant. It seems that the effect of physiotherapy intervention

on muscular strength in women with osteoporosis have been effective. In two of the six selected study has improved muscular strength. So that the effect of an exercise intervention group (0.42- to 0.12) with ci 95% and $p \leq 0.05$, which represents the difference between groups was significant. It seems that the effect of physiotherapy interventions was effective on BMD in women with osteoporosis. So that the effect of an exercise intervention group (0.64 to 0.92) with ci 95% and $p \leq 0.05$, which represents the difference between groups was significant.

Discussion and Conclusion:

Exercise therapy decreases, fracture risk by maintaining bone mass, improve muscle strength and increased personal efficiency through improved postural stability and reducing the rate of failure in patients with osteoporosis (8.27). Regular exercises lead to slow down the aging body's musculoskeletal [4]. Regardless of age, people who their lifestyle approach is active than those who are less active, have higher bone mass, muscle strength and function better in their daily life report [47]. Therefore, to reduce the rate of falls and risk of fracture in women with osteoporosis, RCT must be selected such that interventions to improve bone mineral density, muscle strength and function or quality of life.

Our review systematic study of six study bone density, muscle strength and quality of life for physiotherapy interventions have been evaluated in women with osteoporosis. It concluded that the effectiveness of physiotherapy interventions, including community-based osteofit training (including both strength training and balance) [5] land and aquatic exercise training in the comprehensive program of rehabilitation (hand mobilization, taping and postural corrective exercises), on quality of life in women with osteoporosis was more effective than other items [18,30]. This shows that the difference between groups is significant. According to muscle strength item can also be said that The effect of physiotherapy interventions such as osteofit exercises on the community (including both balance and strength exercises) in two studies on muscle strength in women with osteoporosis was effective that difference between groups was significantly in this item too[5,43]. Finally, the variable bone mineral density, in this systematic review study can be noted that physical therapy interventions including yoga exercises and common practice including 3 steps 1)moderate warm ups 2) stretching for improvement of flexibility 3) improving of postural stability, motor control, coordination and muscle strength [42] on bone mineral density in women with osteoporosis effectively expressed that a significant difference between groups been reported.

A variety of physiotherapy interventions in previous RCT studies have been reported in women with osteoporosis. In our systematic review study, training interventions in 6 RCT study including osteofit training, aquatic exercises versus land, rehabilitation comprehensive programs, Yoga exercises and common exercises [4, 5, 18, 30, 42, 43]. A notable feature was that all the RCT a significant improvement on quality of life, bone mineral density and muscle strength were reported. Of the six study selected for our study, 2 study were included osteofit training for 20 weeks and 10 weeks that osteofit training for 20 weeks has been improved significantly the quality of life and muscle strength [5] although the effect of exercise on quality of life more effective than the item muscle strength have been reported. A study, yoga exercises, a study aquatic training versus land, a study routine exercise therapy and a study rehabilitation comprehensive program involved that this studies have reported positive effects and significant improvement [4, 18, 30, 42].

Ped ro scale scores for RCT studies included in the our systematic review study is considered acceptable and high score which reflects the high quality of RCT studies in our systematic review study. The extracted sizes for the variables such as the bone mineral density, muscle strength and quality of life in our systematic review study was heterogeneous that this issue was limited applicability comparisons .

Aquatic training exercises versus the land, community-based osteofit training (including balance and strength exercises] and rehabilitation comprehensive programs (including hand mobilization, Taping and postural corrective exercises) reported significant intergroup differences that common feature of these exercises, their effective role was in improving the quality of life in women with osteoporosis. Since the quality of life and inability to perform daily activities in patients with osteoporosis has been shown therefore, appropriate training to improve the quality of life and functional ability should be a priority for treatment in these subjects [30]. Aquatic exercises versus the land, for 20 weeks has shown no significant difference in the quality of life in women with osteoporosis who have pursued aquatic training or land compared with the control group, although there was reported greater improvement for land exercises compared to aquatic exercises, in old women with osteoporosis the potential benefits of aquatic exercise on quality of life is mentioned due to reduced gravity, yet to find the significant differences and using aquatic exercise as a alternative treatment and available, Further researchs needs also the potential benefits of aquatic exercises should be interpreted with caution [30]. On the other hand osteofit training based on community which includes both strength training and balance no significant differences between intervention and control groups in total score and quality of life scores at baseline and after 20 weeks has not been reported that may be because women who voluntarily participated in the study at baseline had a significantly higher quality of life and function [5]. In addition, a comprehensive program of rehabilitation (including hand mobilization, taping and postural corrective exercises) have been reported that mental health perception of quality of life items quietly but significantly worse in the intervention group than the control group perhaps for this reason that in this study the most vulnerable subjects to an exodus of patients for various reasons remain this shows that the study was conducted on patients with osteoporosis is high disability old[18].

Osteofit training based on community which includes both balance and strength training in a study in 2002 for 20 weeks and 10 weeks in 2001 reported significant intergroup differences[5,43] the common feature of these exercises was their effective

role to increase muscle strength in women with osteoporosis. Common risk factors for falling, muscle weakness has been noted[8] that between muscles, quadriceps muscle weakness as an independent variable for determining the rate of falls and risk of fracture is considered [6, 8]. Therefore, proper training programs can lead to improved muscle strength and fall-related risk factors, osteofit exercises is demonstrated for 20 weeks which leads to greater improvement in knee extension strength, although insignificant in the intervention group, but control group efficiency in knee extension strength worsened between weeks 10 and 20 although in the intervention group improved. The exercise program was designed mainly for people more healthy and more motivated that this has caused the intervention effects of changes in muscular strength in this population are reported less [5]. In contrast, community-based osteofit training in another study for 10 weeks and spent less time compared to the previous study was conducted to improvement in knee extension strength in the exercise group and the control group was reduced although statistically significant improvement in knee extension strength has not created, This may be due to an exercise program for people with more healthy and more motivated [48] and on the other 10 weeks is expressed a very short time to achieve significant changes in knee extension strength [43].

Yoga exercises and routine exercises consists of three steps:1)moderate warm up 2)stretching for improving of flexibility 3) improving of postural stability, motor control, coordination and muscle strength that reported significant intergroup differences that common feature of these exercises, their positive effect on bone density in patients with osteoporosis has been reported [4, 42]. In patients with osteoporosis, a common finding in these patients, decrease in bone mass and increased fracture risk has been reported[4, 19) On the other hand physical activity to prevent bone loss and bone fractures will be [8] Yoga workout for 6 months resulted in improved bone density in the lumbar spine compared to baseline[4].

In response to the effects of yoga can be said that a dynamic balance between resorption and bone formation naturally by nature are dynamic loading So in response to physical changes in bone mechanical function occurs in the environment [4, 49]. Exercise common treatment resulted in a significant decrease in the density of the forearm bone mineral density in patients with osteoporosis proband in the intervention group 2 and group 3 was Whereas no significant changes were observed in the intervention group 1 [42]. It can be said that only continuous, regular mechanical force will lead to significant changes in bone mass In addition, the findings of previous studies. This study has been approved [50].

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