JSKK (Jurnal Sains Keolahragaan dan Kesehatan)
Vol. 9 No. 2, Desember 2024, pp. 162-176
Web: http://journals.itb.ac.id/index.php/jskk/index

The Effect of Exercise to Prevent Osteoporosis on Bone Mineral Density in Women Aged 25-35 Years

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Diterima: 7 Oktober 2024; Diperbaiki: 5 Desember 2024; Diterima terbit: 30 Desember 2024

Abstract

Reports of surveys on exercises that can increase bone mineral density (BMD) have already been proven in many studies. One of the efforts to organize formal physical exercise for every level of society is the formation of Senam Pencegahan Osteoporosis (SPO) - Physical Exercise to Prevent Osteoporosis. Is SPO able to increase BMD for women aged 25-35 years? A total of 46 healthy young women ranging from 25 -35 years of age who had never done or even were not involved in any exercise before the time of the study were divided into two groups (23 experimental and 23 control participants) and volunteered to proceed a three times a week of this exercise for 3,5 months. BMD was measured by using Dual Energy X-ray Absorptiometry (DEXA). A significant increase of BMD in the ulna, vertebral lumbar 2, and vertebral lumbar 1-2 was detected in the experimental group. There is a strong indication that SPO can increase BMD, especially in the ulna, which has a high risk of osteoporosis.

Keywords: *bone density, exercise, osteoporosis, young women*

INTRODUCTION

Technological and scientific development has caused various changes in habits and the way of life, directly or indirectly influencing health. Advanced technology makes it possible to create sophisticated equipment that makes human work easier, such as cars, washing machines, televisions, and much more. On the other hand, this sophisticated equipment makes people do less physical activity, which is necessary to maintain health (Farhud, 2015).

The continuously improved quality of human life increases life expectancy

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DOI: http://dx.doi.org/10.5614/jskk.2024.9.2.2 e-ISSN: 2654-8860 . p-ISSN: 2477-1791

by more than 60 years. In 2000, the Indonesian elderly population was estimated to reach 20 million people and is expected to jump up to 29 million, or more than 11 percent in 2020. According to the World Health Organization data, this phenomenon is in line with the increase in human life expectancy of Indonesia's people, from 67.2 years in 2000 to 71.3 years in 2019. Furthermore, the life expectancy is projected to be 72.32 in 2023 (Macrotrends, 2023). This situation shows more common degenerative diseases as the consequences of getting older.

Degenerative diseases commonly occur in older people, such as coronary heart disease, cerebrovascular disease (CVD), dementia, and decreased bone density, known as osteoporosis (Lobo & Gompel, 2022). Osteoporosis occurs over a long time and is a cumulative process, so the best response is to take preventive action early on, including regular exercise, good nutrition, and avoiding predispositions such as coffee consumption, fatty foods, alcohol, cigarettes, and others (Weaver et al., 2016).

Data shows that since the 1990s, around 25 million Americans have osteoporosis. Of the data, 80% are women, 1.5 million experience fractures yearly, and half a million experience thoracic vertebral fractures and lumbar, which commonly occur in deformity and hunchback posture. Another quarter million experience hip fractures yearly, and 15-20% cause paralysis and death (Katz et al., 1998). Indonesia has no definite data regarding the fracture number due to osteoporosis per year. However, the increasing number of older people is estimated to increase the risk of fracture experiences (Wulansari et al., 2021).

Osteoporosis commonly attacks older people but can even attack at 24 years because of the lack of body movements in daily activities. The impact of today's technology often makes people reluctant to do much physical activity and frequently sit rather than stand. Preventive efforts are essential to strengthen bones as early as possible until they reach a higher peak bone mass from the average bone growth, generally occurring in the third or fourth decades (Miles, 2007).

Since 2000, several studies have examined the effect of exercise and physical activity on increasing BMD. According to Lloyd et al. (2002), exercise activities such as aerobics in young women can increase BMD in the femoral neck and shaft. Torstveit (2002) also found that involving high-magnitude loading in weight-bearing exercises can maintain or increase BMD in young women. Practicing exercise is expected to increase bone mass to form denser bones. Denser bones will prevent the ongoing process of natural bone density from decreasing throughout the passing of age.

To reduce the morbidity rate from osteoporosis, the Medical Rehabilitation Installation of Cipto Mangunkusumo Hospital and Program Study of Sports Medicine, Faculty of Medicine, Universitas Indonesia, designed the formation of physical exercise to prevent osteoporosis called Senam Pencegahan Osteoporosis (SPO). This exercise combines aerobic and resistance training, which applies pressure and pull to stimulate bone formation and adequate bone density. This exercise raises awareness about the importance of "saving bones for tomorrow."

Moghadasi & Siavashpour (2013), found that women around 25 who did resistance training within three months significantly increased growth hormone, estrogen, parathyroid, and testosterone, which are helpful in bone formation. Greenway et al. (2015),also found that daily physical activity in women aged 20-39 was positively associated with increasing BMD. The women's age range of 25-35 years is the reproductive age where the estrogen hormone is still sufficient, and bone mass is estimated at around 30 years.

Nowadays, osteoporosis exercise is still studied and being used as an effort to prevent osteoporosis, especially in premenopausal age. However, no research has experimentally compared young women who do and do not practice SPO to determine its effect on increasing BMD. This study aims to determine the increase of BMD in women aged 25-35 years before and after doing SPO within 3.5 months and compare the differences between the experimental and control groups. This study is expected to be used as an evaluation material on how much SPO helps increase BMD and contribute to giving any suggestions to optimize this exercise in preventing osteoporosis in society.

METHODS

Study Design

This research uses an experimental method with control. The treatment is "Osteoporosis Prevention Exercise" for 42 weeks (3.5 months). Initially, the research protocol received an ethical review from the Standing Committee for

Research Ethics Assessment, Faculty of Medicine, Universitas Indonesia.

Participants

The research subjects are women aged 25-35 living in Jakarta, Indonesia. Women are chosen because of higher and earlier osteoporosis attacks if compared with men (Bathnagar, 2022). The participants who were included in the experimental group voluntarily registered as SPO participants at Sanggar Bugaria Gelora Rawamangun Jakarta Cycling Road; they were housewives and office clerks. Sanggar Bugaria was chosen as an exercise place because most experimental participants lived around Rawamangun.

This place has training facilities and infrastructure that meet the requirements of an exercise place. There were also three trainers with more than ten years of experience training people with osteoporosis. The subject gets information by reading the displayed banners, friends, or neighbors of Sanggar Bugaria members.

Meanwhile, the control group is female employees at the Faculty of Medicine and Dentistry, Universitas Indonesia, which did not participate in SPO training. The chosen control group considers the location close to BMD testing in Makmal Laboratory, Faculty of Medicine, Universitas Indonesia. They are considered to be healthy, met the inclusion criteria to obtain information about the research objectives, and signed an informed consent letter.

Research Variables

The independent variable of this research is the record of *age, weight*, *height, Body Mass Index (BMI), food intake,* and *SPO.* The age of the subjects was appropriate *for Resident Identity Card,* limited to ages above 24 years and under 36 years old. Body weight was measured with an accuracy of 0.1 kg. Meanwhile, height was measured with an accuracy of 0.5 cm.

Food Intake

An interview was conducted with each participant by an expert nutritionist using food models. This assessment uses the Food Frequency Questionnaire (FFQ) method to determine weekly frequency and food consumption. Interview results were analyzed using the Food Ingredient Analysis List, then calculated calories, carbohydrates, protein, fat, calcium, and phosphorus using SPSS.

Physical Exercise to Prevent Osteoporosis (SPO)

SPO was inaugurated on October 19, 1999, at the Faculty of Medicine, Universitas Indonesia. This exercise invented by the *Osteoporosis Research Group* FKUI and has been introduced to five hospitals in Jakarta. SPO is recommended to increase BMD and reduce bone loss that occurs naturally to minimize fracture risk. Both men and women can do this exercise. Recommended for healthy people aged 30-60 years and not recommended for people with osteoporosis or those who have osteoporosis risk. Coach with an understanding of SPO movement purposes leads the SPO group exercise.

Weight equipment, a mattress pad, an SPO music player, enough room to move around, and gym clothes with sports shoes are needed. The recommended training zone is 60-80% of maximum heart rate. This exercise is carried out in 45 minutes, 3-5 times a week, consisting of low-impact aerobics or weight-bearing and resistance training. The movement, duration, and *beats per minute* (BPM) details are in Table 1.

Table 1. SPO Movements, Duration, and BPM

Movements	Duration (*minutes*)	BPM
Warm-up	10	120
Core 1	10	128
Core 2	10	128
Cool down	5	120
Gymnastics	10	120

This research takes 42 exercises within 3.5 months. The consideration is because the substantial change in bone only occurs for six weeks with 1-hour daily loading (Lyon & Cynthia E. S, 1993). The bone remodeling cycle also occurs in resorption phases lasting 2-4 weeks, and the formation phases last 3-4 months.

Bone Mineral Density (BMD)

Bone mineral density (BMD) is a dependent variable of this research. Bone mineral density is measured using a *Densitometer Dual Energy Xray Absorptiometry* (DEXA) in (g/cm^2). The parts measured are the lumbar vertebrae (L1-L4), proximal left femur (neck, ward, trochanter), bones left forearm radius, and ulna.

Data Analysis

The data was analyzed statistically using the *Significance Test* to determine the suitability difference between the results of two average values before and after exercise with the non-parametric Wilcoxon statistical test Matched-Pairs signed-rank test, with a significance level ≤ 0.05.

RESULTS

The research subject begins with 29 experimental and 25 control participants. As time progressed, eight people dropped out of this study; 3 of them moved out, and five others needed to meet the minimum number of attendees. Eventually, were 23 people left in the experimental group and 23 in the control group. The record of age, weight, height, and *Body Mass Index* (BMI) of both groups is shown in Table 2.

Table 2. Distribution of Subject Characteristics by Group

Characteristics	Group	Mean	SD	z	p
Age (*years*)	Experimental	30.43	3.47	0.84	0.41
	Control	29.56	3.2		
Weight (*kg*)	Experimental	55.87	11.42	1.94	0.053
	Control	49.74	5.99		
Height (*cm*)	Experimental	151.78	4.49	1.88	0.061
	Control	155.09	4.76		
BMI (kg/cm^2)	Experimental	24.14	4.18	2.966	**0.003**
	Control	20.66	2.2		

The results show no significant differences between age, weight, and height in both groups. Meanwhile, there are meaningful differences between the two groups in the BMI. The experimental group has a higher BMI than the control group, but both are still in the healthy weight range for young and middle-aged adults.

Food Intake Characteristics

Calculations via questionnaires using the FFQ method were carried out to determine the food intake of both groups in the pre-test. The results of calculating food intake can be seen in Table 3.

Table 3. Distribution of Group Nutritional Intake in the Pre-Test

Characteristics	Group	Mean	SD	z	p
Calories (*kcal*)	Experimental	1123.75	662.06	1.769	0.077
	Control	817.83	292.64		
Protein (*grain*)	Experimental	41.25	22.66	2.406	0.016
	Control	26.86	11.25		
Carbohydrate (*gram*)	Experimental	206.48	143.56	1.461	0.144
	Control	143.56	60.40		
Fat (*gram*)	Experimental	16.91	10.47	1.088	0.277
	Control	14.10	8.38		
Calcium (*mg*)	Experimental	326.08	231.06	3.065	0.002
	Control	186.02	99.01		
Phosphate (*mg*)	Experimental	500.42	283.04	2.252	0.024
	Control	319.80	135.04		

The results showed that the calories, carbohydrates, and fat consumed by both groups were not significantly different. It implies that both groups have almost the same calorie, carbohydrate, and fat levels. Significant differences were found in the amount of protein intake, which means there were differences in protein contained between both groups. There were also significant differences in calcium and phosphate levels, meaning the two groups had differences in calcium and phosphate intake.

Bone Mineral Density Characteristics

The BMD is checked in the lumbar vertebral, hip, and radius-ulna locations to obtain these results using Bone Densitometry in the FKUI Laboratory section. The results represented both group BMD levels (g/cm^2) in the pre-test, post-test, and comparison of the pre-test and post-test. The results of the BMD checking are shown in Table 4 and Table 5.

Table 4. Pre-Test of BMD Levels in Experimental and Control Groups

Location	Experimental (g/cm^2)		Control (g/cm^2)		z	p
	Mean	SD	Mean	SD		
Neck	0.849	0.14	0.877	0.10	0.648	0.517
Wards	0.813	0.13	0.826	0.14	0.494	0.621
Troch	0.706	0.10	0.699	0.11	0.209	0.835
Radius	0.311	0.04	0.305	0.03	0.385	0.701
Ulna	0.249	0.04	0.236	0.03	1.285	0.199
L 1	0.933	0.15	0.964	0.08	1.100	0.267

L 2	1.012	0.14	1.074	0.10	1.824	0.068
L 3	1.07	0.14	1.125	0.08	1.780	0.075
L 4	1.066	0.14	1.127	0.10	1.736	0.083
L 1-2	0.975	0.14	1.021	0.08	1.538	0.124
L 1-3	1.009	0.13	1.06	0.09	1.670	0.095
L 1-4	1.026	0.13	1.079	0.08	1.593	0.111
L 2-3	1.041	0.13	1.101	0.08	1.879	0.060
L 2-4	1.05	0.13	1.111	0.08	1.714	0.987
L 3-4	1.066	0.13	1.126	0.08	1.769	0.077

Table 4 shows the pre-test results. It showed that BMD in both experimental and control groups was not significantly different. It implies that the two groups have a similar BMD at the beginning of the test. Follow-up tests were carried out to measure BMD after receiving SPO intervention for 3.5 months in the experimental group. For comparison, BMD measurements were also carried out in the control group within 3.5 months after the initial test. The post-test results are shown in Table 5.

Table 5. Post-Test of BMD Levels in Experimental and Control Groups

Location	Experimental (*g/cm*^{2})		Control (*g/cm*^{2})		z	p
	Mean	SD	Mean	SD		
Neck	0.855	0.10	0.883	0.09	0.879	0.380
Wards	0.820	0.12	0.840	0.12	0.527	0.598
Troch	0.712	0.09	0.704	0.11	0.297	0.767
Radius	0.310	0.04	0.304	0.03	0.121	0.904
Ulna	0.257	0.04	0.244	0.03	0.242	0.214
L 1	0.960	0.14	0.986	0.08	0.945	0.345
L 2	1.029	0.16	1.076	0.09	1.604	0.109
L 3	1.066	0.14	1.130	0.09	2.032	**0.042**
L 4	1.066	0.13	1.140	0.10	2.131	**0.033**
L 1-2	0.990	0.15	1.028	0.09	1.208	0.269
L 1-3	1.019	0.14	1.066	0.08	1.516	0.129
L 1-4	1.033	0.14	1.088	0.08	1.769	0.077
L 2-3	1.049	0.14	1.104	0.08	1.857	0.063
L 2-4	1.055	0.13	1.117	0.08	1.966	**0.049**
L 3-4	1.066	0.13	1.135	0.08	2.054	**0.040**

The post-test results show significant differences in L3, L4, L2-4, and L3-4, indicating that the control group has a higher BMD than the experimental group. A pre-test and post-test results were compared to determine the increase in BMD due to the SPO intervention. The comparison results are shown in Table 6.

Table 6. Comparison of Pre-Test and Post-Test BMD Levels

		N	Pre-Test (g/cm^2)		Post-Test (g/cm^2)		z	p
			Mean	SD	Mean	SD		
Neck	Experimental	23	0.894	0.14	0.855	0.10	0.7452	0.4562
	Control	23	0.877	0.10	0.883	0.09	0.2737	0.7843
Wards	Experimental	23	0.813	0.13	0.820	0.12	0.5475	0.5841
	Control	23	0.826	0.14	0.840	0.12	1.3535	0.1759
Troch	Experimental	23	0.706	0.10	0.712	0.09	1.2188	0.2236
	Control	23	0.699	0.11	0.704	0.11	0.8928	0.3720
Radius	Experimental	23	0.311	0.04	0.310	0.04	0.2129	0.8314
	Control	23	0.305	0.03	0.304	0.03	0.3302	0.7413
Ulna	Experimental	23	0.249	0.04	0.257	0.04	2.3375	0.0194
	Control	23	0.236	0.03	0.244	0.03	1.7945	0.0727
L 1	Experimental	23	0.933	0.15	0.960	0.14	1.9668	0.0619
	Control	23	0.946	0.08	0.986	0.08	2.3051	0.0212
L 2	Experimental	23	1.012	0.14	1.029	0.16	2.3724	0.0177
	Control	23	1.074	0.10	1.076	0.09	0.8516	0.3944
L 3	Experimental	23	1.070	0.14	1.066	0.14	0.2110	0.8329
	Control	23	1.125	0.08	1.130	0.09	0.6995	0.4842
L 4	Experimental	23	1.066	0.14	1.066	0.13	0.0606	0.9515
	Control	23	1.127	0.10	1.140	0.10	1.4295	0.1529
L 1-2	Experimental	23	0.975	0.14	0.990	0.15	2.2400	0.0251
	Control	23	1.021	0.08	1.028	0.09	1.8401	0.0658
L 1-3	Experimental	23	1.009	0.130	1.019	0.14	1.8882	0.0914
	Control	23	1.060	0.090	1.066	0.08	1.4447	0.1485
L 1-4	Experimental	23	1.026	0.13	1.033	0.14	1.3034	0.1924
	Control	23	1.079	0.08	1.088	0.08	1.9161	0.0553
L 2-3	Experimental	23	1.041	0.13	1.049	0.14	1.3687	0.1711
	Control	23	1.101	0.08	1.104	0.08	0.8655	0.5057
L 2-4	Experimental	23	1.050	0.13	1.055	0.13	0.9253	0.3548
	Control	23	1.111	0.08	1.117	0.08	1.2470	0.2124
L 3-4	Experimental	23	1.066	0.13	1.066	0.13	0.0152	0.9879
	Control	23	l.126	0.08	1.135	0.08	l.4295	0.1529

The results indicate that SPO interventions can increase BMD in several locations. Table 5 shows that BMD levels in the experimental group significantly increased in the ulna, L2, and L1-2 vertebrae. Meanwhile, in the control group, BMD increased only on the L1 vertebra within 3.5 months after the first check.

Result of Additional Questionnaire Distribution

The questionnaire was distributed to complete the additional factors that may influence BMD. This questionnaire contains several questions, including consumption of additional calcium medication, sun exposure, use of sunscreen, daily weight lifting activities, and daily walking activities. The results of distributing additional questionnaires can be seen in Table 7.

Table 7 The Results of Questionnaires Related to BMD Factors

Question		Experimental	Control	x^2	p
1. Regularly take additional calcium medication.					
a) No 23 20		23	20	3.21	0.732
b) Yes	a) 500 mg/day	0	3		
	b) 1000 mg/day	0	0		
2. Rarely affected sunlight in daily activities.					
a) No		10	11	0.09	0.7672
b) Yes		13	12		
3. Often, wear sunscreen cream when going out.					
a) No		17	5	10.6	0.0011
b) Yes	a) Early morning	4	17	0.82	0.3656
	b) Around 09.00-15.00	2	1		
4. Often lifting in daily activities.					
a) No		10	14	2.19	0.1389
b) Yes	a) <1/2 kg/day	7	4	2.2	0.1383
	b) 1/2-1 kg/day	1	3		
	c) >1 kg/day	5	2	0	0.9483
5. Frequent walking in daily activities					
a) No		6	3	1.24	0.2649
b) Yes	a) 1-2 km/day	6	15	4.4	0.036
	b) 3-5 km/day	6	5		
	c) > 5 km/day	5	0	4.52	0.0335

Besides food, additional calcium intake can be obtained from regular consumption of 500 *mg* and 1000 *mg* tablets. It can also be obtained through sunlight exposure in daily activities. Of the results, both are not significantly different in calcium intake. The control group walked more often daily than the experimental group. This habit affects the BMD of L1 in the control groups.

In contrast, daily lifting activities do not have a significant difference. Apart from that, a significant difference was found in using sunscreen cream. There was a significant difference in the intensity of skin protection against vitamin D, where the control group used more sunscreen on the face.

DISCUSSION

The mean of the experimental group age was 30.43 years, and the control group was 29.56 years old. Both groups are suitable for increasing BMD, which will reach peak trabecular bone formation between the ages of 25-40 and cortical bone between 35-40 years (Birdwood, 1996; Katz et al., 1998). The experimental group's body weight was 55.87 kg, and the control group was 49.74 kg. Both groups have no significant differences and can be considered balanced body weight, which does not affect the BMD differences. Weight differences will affect the differences in BMD. Being underweight causes a lack of mechanical weight that can stimulate BMD against gravitational forces, while being overweight will increase BMD more quickly (Marcus, 1996; Rikkonen et al., 2021). So, the balanced weight is also considered the balanced bone loading.

Statistically, there was no significant difference in both groups' height. It implies that the balanced height of the experimental and control group were not a factors that will affect the BMD. Meanwhile, the mean BMI showing a significant difference between the experimental group was 24.14 kg/cm^2 and the control group was 20.66 kg/cm^2. According to statistical data, this significant difference could be an influential factor in BMD. However, according to the World Health Organization classification, a BMI of around 18.50-25.00 kg/cm^2 is categorized as average weight, which has enough mechanical load on the bones during exercise to increase the BMD. The characteristics obtained from both groups showed an insignificant difference, so the subjects in this study were considered to have the same characteristics.

Pre-Test Food Intake

Calcium is a bone-building substance that is essential to the body's metabolism. However, this substance is not produced by the body and must be obtained from outside. The *Food Frequency Questionnaires* (FFQ) determine the participant's nutritional intake, especially calcium. The FFQ method records food consumed daily to calculate the frequency and quantity of certain foods weekly (Burke, 1994). A nutritionist carries out the calculations to avoid errors.

The results showed no significant differences in both research groups' calorie, carbohydrate, and fat intake. Meanwhile, there are significant differences in protein intake between experimental groups 41.25 *grams* and control groups 26.86 *grams*. Statistically, protein intake could be an interfering variable. However, protein will only affect blood calcium if meat is consumed excessively. The National Academy of Sciences Food and Nutrition Board recommends 50 *grams* of protein daily in adult women. So, in this study, calories, carbohydrates, fat, and protein intake do not affect BMD.

The National Institute of Health recommends a calcium intake of approximately 1000 *mg* daily at ages 19-50. Identifying the calcium intake of both research groups in this study is necessary. There are significant differences in calcium intake between the experimental group, 326.08 *mg*, and the control group, 186.02 *mg.* Likewise, the significant difference in phosphate intake between the experimental group was 500.42 *mg,* and the control group was 319.80 *mg.* So, these two minerals can be an influence factor in BMD. Calcium is the most abundant substance in bones, and in this study, the experimental group has a higher calcium and phosphate intake.

Pre-Test Bone Mineral Density

The measurement of BMD in the experimental and control groups in the pre-test using a *Bone Densitometry* tool. The results were tested statistically and showed no significant differences from both groups. It implies that both experimental and control groups have the same BMD at the beginning of the study.

Post-Test Bone Mineral Density

After 3.5 months, BMD testing using *Bone Densitometry* tools was carried out in both groups. The results show significant differences in L3, L4, L 2-4, and L3-4. This test found that BMD values in the control group were denser than the experimental group. Several indications might cause this condition. **First,** the questionnaire results describe that the control group's daily walking activities are more significant than the experimental group. **Second,** the movements of SPO do not improve BMD due to less weight, reduced bone stimulation due to not increasing weight, the weight exercise is not evenly distributed across all locations, and insufficient exercise frequency.

Changes in Bone Mineral Density After Physical Exercise to Prevent Osteoporosis

After running the SPO for 3.5 months, there was a significant increase in both research groups. There was a significant increase in ulna, L2, and L1-2 in the experimental groups. In the control group, there was a significant increase in L1.

Significant differences in BMD in the ulna due to SPO are caused by *Core 2* movements using dumbbells/weights in the hands, which provide a meaningful impact on increasing bone density.

Trained muscles supported by the skeleton will adapt to stress from training movements, increasing bone minerals. SPO caused a significant increase of L2 vertebrae in the experimental group, held routinely three times a week, and affects bone mass. This occurs through a type of muscle contraction in weight-bearing and non-weight-bearing activities.

The weight-bearing exercise and resistance training combination is beneficial to improve functional performance in people who have suffered bone loss and increased spinal and hip bone density (Watson et al., 2015; Zhao et al., 2015). The results of this study have theoretical implications for the new finding of increased BMD occurring in the Ulna as a result of SPO, which also combines weight-bearing exercise and resistance training.

CONCLUSION

Doing osteoporosis prevention exercises or SPO 3 times a week for three months will increase BMD in women aged 25-35, especially in the ulna, L2, and L1-2. In the experimental group, BMD in the L4 did not increase and decreased in L3. It can be concluded that SPO movements do not train the parts of L3 and L4. In the control group, BMD in the L1 was increased. This is related to walking habits in their daily activities. The calcium intake average in this study was less than the recommendation.

Osteoporosis prevention exercises must add the weight magnitude periodically due to bone loading adaptation, exercise frequency, length of weight training, and back muscle training. Future research needs to identify: a) the influence of calcium intake on BMD according to established recommendations; b) the decrease of BMD in L3; c) not increase BMD in L4; d) not increase or decrease BMD in the radius bone even with weight exercise, compare to the increasing in ulna bone.

Apart from doing SPO, carrying out weight/bearing movements such as walking, riding a bicycle, climbing stairs, and lifting objects with the correct posture in daily activities is recommended. Before doing SPO, it is recommended to suspect and detect osteoporosis early in young women who rarely do physical activity by weight-bearing exercise without weights or are able to take the BMD test.

Abdominal stretching in SPO is done by folding towards the stomach. This causes stomach muscle tension. It is recommended to replace by straightening the legs parallel to the floor. The rhythm of the BPM is too fast. Movements in floor exercise are done hastily, which can cause back injuries. It is recommended to slow down the rhythm of the beat. In floor exercise, the head raises movement with hands behind in the supine position should be done with straightening arms up or putting hands at eras sides to avoid head injury.

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