

Original Paper

Effect of Squat Exercises on Fatigue and Quality of Life (QoL) of Pregnant Women: A Randomized Controlled Trial Study



Maryam Malmir¹ , Seyedeh Zahra Masoumi^{2*} , Farideh Kazemi³ , Mansoureh Refaei⁴ 

1. Midwifery (Msc), Department of Midwifery, School of Nursing and Midwifery, Hamadan University of Medical Sciences, Hamadan, Iran.

2. Associated Professor, Department of Midwifery, Mother and Child Care Research Center, School of Nursing and Midwifery, Hamadan University of Medical Sciences, Hamadan, Iran.

3. Instructor, Department of Midwifery, School of Nursing and Midwifery, Mother and Child Care Research Center, Hamadan University of Medical Sciences, Hamadan, Iran.

4. Associated Professor, Department of Midwifery, Mother and Child Care Research Center, School of Nursing and Midwifery, Hamadan University of Medical Sciences, Hamadan, Iran.

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ABSTRACT

Introduction: Research has shown that many pregnant women in Iran do not exercise during pregnancy. However, exercise, especially endurance exercise during pregnancy, is associated with good maternal and fetal outcomes.

Objective: The study aimed to examine the effect of squat exercises on fatigue and the life quality of pregnant women admitted to health centers in Hamadan City, Iran.

Materials and Methods: The study was a randomized controlled clinical trial conducted from September 2019 to February 2020 on 100 pregnant women in two groups of 50 each. The pregnant women were randomly using blocks of four divided into two groups according to the inclusion criteria. The samples filled out the fatigue questionnaire Multidimensional Symptoms Fatigue Inventory-Short Form (MSFI-SF) and SF-36 life quality questionnaire at the beginning of the study. Eight group sports sessions were held for women in the intervention group, and routine care was administered to the control group. The obtained data were analyzed using the independent t-test, Mann-Whitney U test, Chi-square test, and Analysis of Covariance (ANCOVA) at a significance level of 0.05.

Results: The Mean±SD age of participants was 28.24±5.39 years in the intervention group and 27.78±5.58 years in the control group. The mean scores of fatigue and life quality in all dimensions in the post-intervention stage (after adjusting for before-the-intervention scores, income, and housing status) were significantly different between the study groups. The mean fatigue score in the intervention group was lower, and the quality of life (QoL) was better (P=0.001) than in the control group. The effect size of different domains of QoL varied from 1.51 (energy fatigue) to 3.50 (physical function). The effect size of fatigue was 2.81 (95%CI: 3.36- 2.25, P=0.001).

Conclusion: Based on the results, squat exercises are recommended to reduce fatigue and increase the life quality of pregnant women in health centers.

* Corresponding Author:

Seyedeh Zahra Masoumi, Associated Professor

Address: Department of Midwifery, Mother and Child Care Research Center, School of Nursing and Midwifery, Hamadan University of Medical Sciences, Hamadan, Iran.

Tel: +98 (918) 3129058

E-mail: zahramid2001@gmail.com

Highlights

- Doing endurance exercises during pregnancy helps pregnant mothers to have a better quality of life (QoL) during pregnancy.
- Pregnancy outcomes will be better with squat exercise.
- Exercise during pregnancy reduces the fatigue of pregnant women.

Plain Language Summary

Numerous studies have shown that the QoL declines due to physiological changes during pregnancy. Also, many pregnant women complain of fatigue during pregnancy. Exercise, especially resistance exercise, is associated with improved QoL and reduced fatigue. The purpose of physical exercises during pregnancy is to maintain the condition of the muscles of the mother's body so that she can be physically and mentally prepared for childbirth. Proper exercise makes the mother have a better process during pregnancy. It accelerates blood circulation and oxygen uptake and puts the body in a position to carry the baby with less fatigue. Another reason is that exercise strengthens the muscles, which will play a major role during childbirth. Softening the hip joints prepares the body for faster and easier delivery. Finally, exercise allows different body parts to regain their natural shape sooner after delivery. This study showed that doing resistance exercises such as squats improved fatigue and QoL in pregnant women.

Introduction

Pregnancy is one of the most important stages of a woman's life. Although this period is a happy period for most women, it is usually a stressful period along with physiological and psychological changes [1]. The changes during this period are beyond the woman's control and make her physically and mentally vulnerable. Besides, the conditions like nausea and vomiting, pain and cramps, varicose veins, sudden pain below the ribs, edema, weight changes, and, most importantly, fatigue can significantly affect the daily activities of pregnant women [2]. Fatigue and low energy are common during pregnancy [3]. Fatigue is a multi-factor, multidimensional complex state [4] with a self-diagnosed state in which the person feels exhausted and loses physical strength and mental capacity [5]. The cause of fatigue in pregnancy is unknown. However, progesterone may contribute to fatigue in pregnant women. Moreover, factors like decreased blood pressure, hypoglycemia, metabolic changes, and physiological anemia of pregnancy can lead to fatigue [6]. In the studies conducted, several adverse effects have been attributed to maternal fatigue, including improper uterine contractions during labor [7], decreased management of daily activities, feeling depressed [8], increased incidence of cesarean delivery, poor sleep, preterm delivery, and low birth fetal weight [7].

Fatigue during pregnancy reduces the life quality of pregnant women. Pregnancy leads to physical and psychological changes in women's lives that may affect their perception of life quality. The changes that women undergo during pregnancy may cause personal dissatisfaction [9].

Life quality is a specific understanding of life satisfaction, physical health, social health, family and hope, etiquette, and mental health [10]. Pregnancy can heavily affect women's life quality. Women with lower life quality experience more health problems and pregnancy complications and may need treatment. This condition increases their stress [11]. Regular exercise is now recommended for a better quality of life (QoL) for pregnant women and for reducing their anxiety and depression during pregnancy [12]. Furthermore, it reduces the symptoms of depression and has positive effects on the mother's mental health. Regular exercise in the first 20 weeks of pregnancy reduces the risk of preeclampsia by up to 34% [13].

Exercise helps prevent deep thrombosis by helping speed up blood circulation in the lower limbs. Moreover, exercise during pregnancy leads to a reduction in low back pain complaints, prevention and control of diabetes, and overall increased life quality during pregnancy [14]. Over time, various exercises have been recommended for pregnant women. One of these exercises is squat [15].

The squat exercise is one of the most useful exercises that can be used during pregnancy with all the benefits of exercise. Among the benefits of these exercises during pregnancy, one can state prevention of unnecessary overweight, leg varicose veins and muscle cramps, false pain caused by anxiety [16], strengthening the stabilizing muscles of the spine, fillet muscles of the back, quadriceps muscles, strengthening the pelvic floor muscles, the opening of the pelvis and placing the head in the pelvis, strengthening and increasing the muscle strength that is essential for daily activities during pregnancy and gaining a proper and cheerful mood, each of which can have a significant role in enhancing the life quality of pregnant women [15]. During pregnancy, the load on the lower extremities increases due to the decreased ability to control the body, increased spinal lordosis, decreased abdominal muscle strength, and joint strain [17]. Thus, anti-gravity and muscle strength exercises are essential for improving control during pregnancy. Squat exercise has been cited as an anti-gravity and resistance exercise [18].

As life quality and fatigue during pregnancy have a significant role in the health of pregnant women and few studies have been done about the life quality and fatigue and the beneficial effects of squat exercises during pregnancy, the present study was designed and conducted to examine the effect of the squat exercise on fatigue and life quality among the pregnant women.

Materials and Methods

The research was an interventional and randomized clinical trial study with a pretest and posttest design with a control group. This study was conducted in comprehensive health centers of Hamadan City, Iran, from September 2019 to February 2020. We used the sampsi module in Stata v.13 software to calculate the sample size. Using the data obtained by O'Connor et al. [19] and considering a 30% reduction in the fatigue score, the sample size was calculated as 50 people with a 10% drop for each group ($\alpha=0.05$, $\text{Mean} \pm \text{SD}$ 1= 6 ± 4.5 , 2= 8.64 ± 4.5 , $\text{power}=0.80$).

The inclusion criteria were lack of any obstetric complications in pregnancy, sports ban during pregnancy, underlying diseases, mental illness, and muscle diseases based on the mother's statements and the contents of the health file. Absolute rest conditions during pregnancy, having a single fetus, and gestational age of 20-30 weeks based on ultrasound or last menstrual period were other inclusion criteria.

Any obstetric complications during pregnancy, not attending training sessions for more than one session, and undergoing significant psychological and emotional changes (like the death of a loved one or important disputes) were the exclusion criteria.

Demographic data and QoL and fatigue questionnaires were used in this study. Demographic data questionnaire items included age, gestational age, Body Mass Index (BMI), income, wanting to get pregnant, previous infertility, level of education, job, and status of living place. The 36-item life quality questionnaire (SF-36) has 36 questions with 8 subscales, and each subscale consists of 2 to 10 items. The eight subscales of the questionnaire are physical functioning, role physical, role emotional, energy fatigue, emotional well-being, social functioning, pain, and general health. Moreover, two general subscales, physical health and mental health, are obtained by merging the subscales. In this questionnaire, a lower score shows a lower life quality, and vice versa [20]. In this study, we used the Persian psychometric version of this questionnaire [21]. Life quality questionnaire reliability in our study was obtained as 0.89 using the Cronbach alpha.

The other questionnaire was Multidimensional Symptoms Fatigue Inventory-Short Form (MSFI-SF), composed of 20 items. The total score of each domain is 4-20, and the total score of fatigue, determined by the sum of the scores of the domains, can be from 20 to 100. A higher score shows higher fatigue. The fatigue questionnaire has general, physical, emotional, psychological, and energy dimensions, and in a study, the internal consistency of the domains was 0.96, 0.85, 0.93, 0.90, and 0.88, respectively [22, 23].

The reliability of the questionnaires used in our study was appropriate. MSFI questionnaire reliability in our study was obtained as 0.85 using the Cronbach alpha.

Sampling was performed using random block size 4. Prior to the study, the allocation sequence was determined by a non-research team member. Then, the participants were assigned to one of the groups based on a predetermined sequence if they met the inclusion criteria (Figure 1).

After explaining the study procedure and emphasizing the confidentiality of participants' information, the pregnant women signed the written consent form of Hamadan University of Medical Sciences and then completed the questionnaires.

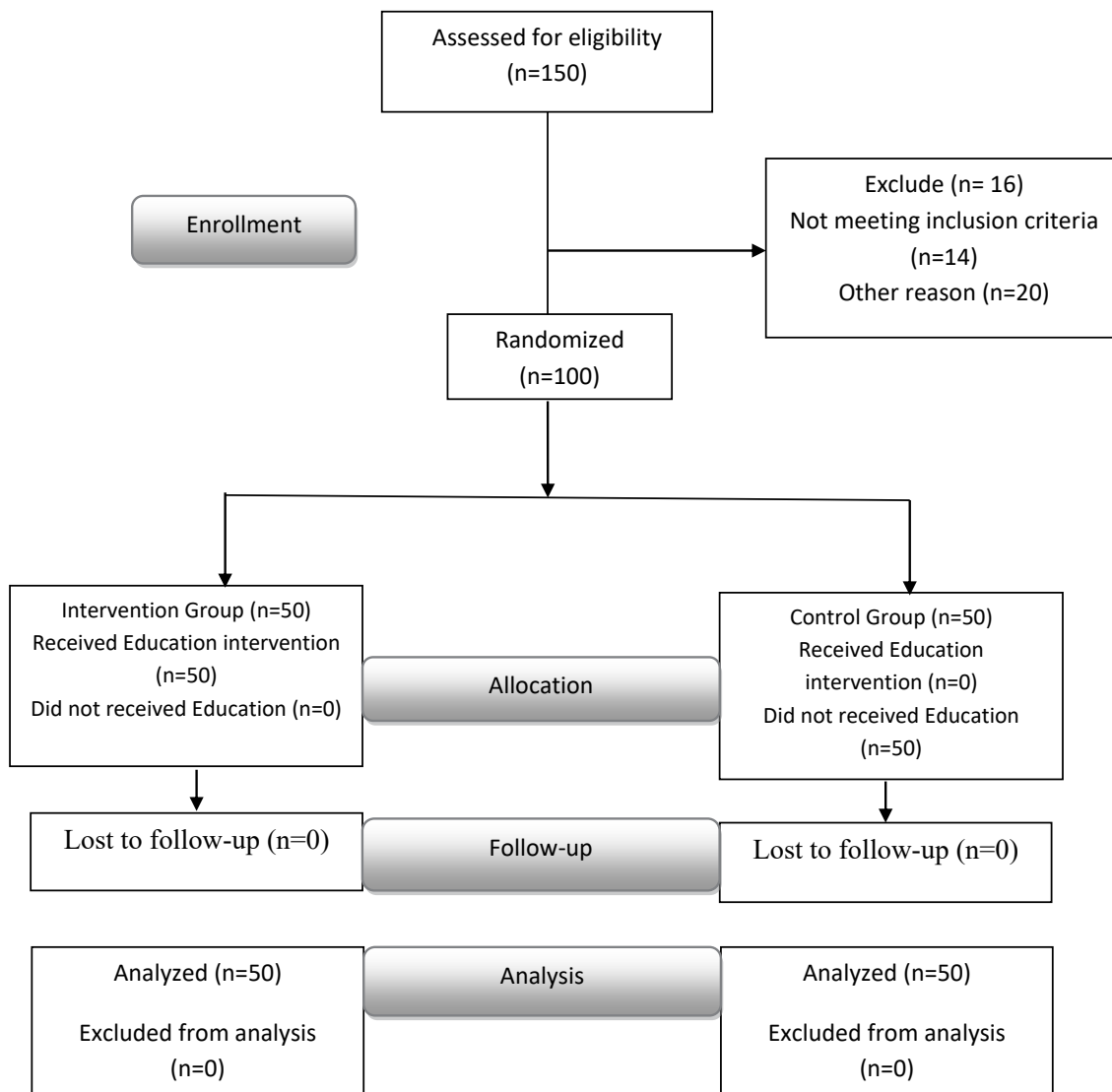


Figure 1. CONSORT flow diagram of selecting the study participants

For the interventional group, the intervention was performed in groups of 8 to 10 people in comprehensive health centers. Exercises are performed in the physical exercise room at the health center by a researcher who is a sports coach and has obtained the necessary certificates. The exercises were first performed in small numbers and sets. Then, with the continuation of the next sessions and better physical fitness, more intensity and several sets of exercises were performed. Methods for reducing pain and cramps were taught, such as taking a warm shower after exercise, using comfortable cotton clothes after exercise, getting more rest, and using hot and cold compresses. Also, two weeks after the sessions, telephone counseling was performed to follow up and avoid muscle problems. The squat program was held for 8 consecutive weeks, one session per week and 50 minutes each (Table 1). In the control group, routine

treatment and care were performed. All methods were performed in accordance with the relevant guidelines and regulations, and squat exercise did not have any side effects for the mother or fetus [24].

Participants in two groups completed fatigue and QoL questionnaires 2 weeks after the intervention. Data analysis was done using the Kolmogorov-Smirnov, Independent t-test, Mann-Whitney U test, the Chi-square test, and ANCONA in Stata v. 13. Cohen's d was reported as the effect size. The significance level was considered at 0.05.

Results

The Mean±SD age of pregnant women participating in the intervention group was 28.24±5.39 years, and in the control group, it was 27.78±5.58 years. The

mean BMI in the intervention group was 24.65 ± 3.77 kg/m², and in the control group, 20.24 ± 3.45 kg/m². The Mean \pm SD gestational age in the intervention group was 27.72 ± 3.61 weeks and 26.26 ± 4.09 weeks in the control group. Most people in the intervention (76.0%) and control (84.0%) groups were nulliparous. Most participants lived in their owned properties in the intervention group (48%) and the rental houses in the control group (52%); the two groups were homogeneous ($P < 0.05$) in terms of demographic characteristics except for the status of living place and income (Table 2).

The results showed (Table 3) that by controlling the effect of pre-intervention scores, income, and housing status in the post-intervention stage, the Mean \pm SD fatigue score was lower in the intervention group than in the control group (38.62 ± 6.43 vs 56.73 ± 6.43) and this difference was statistically significant (Cohen's $d = 2.81$, 95%CI: 2.25-3.36).

Comparison of different areas of QoL between the two groups also showed a statistically significant difference between the two groups in all areas. For example, the results showed that in the post-intervention stage (after controlling the effect of pre-intervention

scores, income, and housing status), the Mean \pm SD of the physical function score was 82.92 ± 8.68 in the intervention group and 52.47 ± 8.68 in the control group (Cohen's $d = 3.50$, 95%CI: 2.87-4.13). Also, the Mean \pm SD of general health in the intervention group was higher than the control (82.53 ± 11.17 vs 57.47 ± 11.17), and these differences were statistically significant (Cohen's $d = 2.24$, 95%CI: 1.73-2.74). The rest of the information is presented in Table 4.

Discussion

This study aimed to examine the effect of squat exercises on fatigue and life quality among pregnant women. The results showed that squat exercises reduced fatigue in pregnant women. O'Connor et al. conducted a study in the southeastern United States. This study showed that low to moderate-intensity resistance exercises during the 22nd to 34th week of pregnancy reduce fatigue [19]. Mahmoudirad et al., in a study in Nehbandan City, Iran, showed that Benson's relaxation exercises have been effective in reducing fatigue in pregnant women [25]. The results of our study were in line with those of this study. A randomized clinical trial study by Ghaffari et al. was done in Iran. The purpose of that study was

Table 1. Content of training sessions

Session	Running Time (Week)	Exercise Content	Duration of the Meeting (Minute)
1 st	20-22	Warm up for 10 minutes, exercises for muscle preparation, practice shoulder width squats with balls for three sets of 10 reps, 1 set without the ball, cooling for 10 minutes	50
2 nd	22-24	Warm up for 10 minutes, exercises for muscle preparation, practicing shoulder width squats, three 10-rep sets of the goblet squat, ten strokes while sitting at the end of the last set, cooling for 10 minutes	50
3 rd	24-26	Warm up for 10 minutes, exercises for muscle preparation, three 10-rep sets of narrow stance squats, three 10-rep sets of heels stuck together squats, three 10-rep sets of shoulder width squats, cooling for 10 minutes	50
4 th	26-28	Warm up for 10 minutes, exercises for muscle preparation, three sets of goblet squats with 8, 10, and 12 reps, and ten strokes at the end of each set, three 10-rep sets of side squats, three 10-rep sets of shoulder width squats, cooling for 10 minutes	50
5 th	28-30	Warm up for 10 minutes, exercises for muscle preparation, three sets of sit squat with 8, 10, and 12 reps, three 10 seconds sets of full sitting squats, cooling for 10 minutes	50
6 th	30-32	Warm up for 10 minutes, exercises for muscle preparation, three 10-rep sets with the ball, three 10-rep sets of an overhead squat, three 10-rep sets of goblet squats, three 10-rep sets of glutes squats, cooling for 10 minutes	50
7 th	32-34	Warm up for 10 minutes, exercises for muscle preparation, three 10-rep superset squats, shoulder width squats, crab squats, three 10-rep supersets of the goblet squat, glutes squats, ten strokes while sitting at the end of the last set, cooling for 10 minutes	50
8 th	34-36	Warm up for 10 minutes, exercises for muscle preparation, three 10-rep superset squats with the ball, three sets of full squats, shoulder width squats only concentration seated, three intermittent supersets of side squat, goblet squat, cooling for 10 minutes	50 minutes, group exercises

Table 2. Comparing demographic characteristics between the intervention and control groups by the chi-square, fisher exact, and independent t-tests

Variable		Mean±SD/No. (%)		P
		Intervention	Control	
Body Mass Index (kg/m ²)		24.65±3.77	24.20±3.45	0.53*
Age (y)		28.24±5.39	27.78±5.58	0.67*
Gestational age (wk)		27.72±3.61	26.26±4.09	0.06*
Income (US \$)		330±9.88\$	293.33±7.88\$	0.01*
Wanting to get pregnant	Yes	41(82.0)	34(68.0)	0.10**
	No	9(18.0)	16(32.0)	
History of infertility	Yes	4(80.0)	4(80.0)	0.99**
	No	46(92.0)	46(92.0)	
History of physical activity	Yes	21(42.0)	20(40.0)	0.83**
	No	29(58.0)	30(60.0)	
Education	High school	3(6.0)	0(0.0)	0.29**
	Diploma	14(28.0)	16(32.0)	
	Academic	33(66.0)	34(68.0)	
Job	Employed	14(28.0)	13(26.0)	0.82**
	Housewife	36(72.0)	37(74.0)	
Number of deliveries	Nulliparity	38(76.0)	42(84.0)	0.31**
	Multiparity	12(24.0)	8(16.0)	
Housing status	Rental	16(32.0)	26(52.0)	0.003**
	Owned	24(48.0)	24(48.0)	
	Organizational	3(6.00)	0(0.0)	
	Living with the spouse's parents	7(14.0)	0(0.0)	

*The Independent t-test, **The Chi-square test, and the rest: Fisher exact-test.

to evaluate the impact of plantar reflexology on fatigue severity in pregnant women. The results showed that the mean score of fatigue after exercise in pregnant women decreased [26]. Aerobic and endurance exercise increases endorphins and energy in the body and increases blood oxygen levels, and reduces fatigue. Resistance exercises improve balance, strength, coordination, flexibility, and endurance, as well as self-reliance and self-confidence, which are the basic criteria in improving the QoL.

The present study showed that squat exercises improved life quality in pregnant women. The results were in line with those of Sedaghati et al. for examining the effect of aqua gymnastics exercises on the life quality of pregnant women in Tehran, Iran. The study had two experimental and control groups. The QoL and general health of pregnant women improved with aqua gymnastics [27]. Parsa et al. conducted a study to examine the effect of group counseling on the life quality of diabetic pregnant women in Hamadan

Table 3. Comparing mean fatigue scores in the intervention and control groups

Study Group	Mean±SD	Cohen's d* CI95% (Lower-Upper)	F	p***
	After the Intervention Adjusted**			
Intervention	38.62±6.43	2.81(2.25-3.36)	175.33	0.001
Control	56.73±6.43			

* Cohen's d interpretive areas: 0.20–0.40 considered small, 0.50–0.70 considered moderate, and ≥0.80 considered large.

** Adjusting for before-the-intervention scores, income, and housing status.

*** ANCOVA test.

City, Iran. The results showed that different levels of life quality improved significantly after the implementation of the educational intervention [28], and our results are consistent with that study. A clinical trial study was performed by Kolu et al. in Finland to investigate the effect of physical activity on the QoL in diabetic pregnant women. The results showed that

following the rules of physical activity was associated with higher QoL at the end of pregnancy and regular physical activity associated with enhancement of daily activities and happiness in the third trimester of pregnancy [29]. The results of the present study have been in line with their study.

Table 4. Comparing the mean score of different dimension of the SF-36 quality of life questionnaire in the intervention and control groups

Variables	Group	Mean±SD	Cohen's d CI95% (Lower-Upper)	F	p**
		After the intervention Adjusted*			
Physical Function	Intervention	82.92±8.68	3.50 (2.87-4.13)	270.96	0.001
	Control	52.47±8.68			
Role physical	Intervention	20.42 ±23.21	1.81 (1.34-2.27)	71.04	0.001
	Control	62.57±23.21			
Role emotional	Intervention	9.77±26.08	1.52 (1.07-1.96)	51.81	0.001
	Control	49.55±26.08			
Energy fatigue	Intervention	75.38±10.88	1.51 (1.06-1.95)	57.92	0.001
	Control	56.91±10.88			
Emotional well-being	Intervention	82.45±10.37	2.46 (1.93- 2.97)	128.02	0.001
	Control	56.92 ±10.37			
Social functioning	Intervention	83.14±14.41	2.66 (2.11- 3.19)	155.29	0.001
	Control	44.77±14.41			
Pain	Intervention	79.75±14.17	3.11 (2.52-3.69)	209.69	0.001
	Control	35.62±14.17			
General health	Intervention	82.53±11.17	2.24 (1.73- 2.74)	108.13	0.001
	Control	57.47±11.17			

*Adjusting for before-the-intervention scores, income, and housing status.

** ANCOVA test.

Another study by El-Rafie et al. was performed on pregnant women in Cairo, Egypt. The results indicated that in individuals who received regular exercise, including walking, aerobic exercise, and relaxation for 12 weeks, improvement in depression and QoL after delivery were observed [30]. Due to the beneficial effects of squat exercises during pregnancy, the training of these exercises during pregnancy is recommended by health professionals and especially midwives in health clinics. The lack of careful supervision of participants' homework and exercise outside of training classes has been the limitation of our study.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of [Hamadan University of Medical Sciences](#) approved the study (Code: IR.UMSHA.REC.1398.423). Written informed consent from all participants in the study, and they were assured that their personal information would remain confidential. Also, exercise therapy was carried out for the control group after the study. Also, This trail was also registered at [Iranian Registry of Clinical Trials](#) (Code: IRCT20120215009014N292).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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