

Effectiveness of a clinical pilates program in women with chronic low back pain: A randomized controlled trial

Pilates for back pain

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Abstract

Aim: The aim of this study was to show the effects of clinical Pilates program in women with chronic non-specific low back pain (CNLBP).

Material and Methods: Forty volunteer women aged 30-45 years with CNLBP for three months were included in this study. They were randomized to either a Pilates (n= 20) or a home exercise group (n= 20). Both groups participated in a 2- hour back-school education program. Pain intensity, muscle strength, pulmonary function, balance ability, and disability level were measured before and after the program (eight weeks). Participants in the Pilates program attended an 8-week Pilates regime (3 times in a week, for 45 min) supervised by an experienced physiotherapist. Home exercise group participants were advised doing a selected exercise program by a physiotherapist 3 times a week.

Results: Pilates participants showed significant improvements in pain intensity, muscle strength, pulmonary function, disability level, and balance ability ($p \leq 0.05$). There was no superiority for trunk flexion strength and pulmonary function between clinical Pilates and home exercise groups ($p > 0.05$). Clinical Pilates is more effective than home exercises for CNLBP in terms of pain, muscle strength, balance ability and disability level ($p \leq 0.05$).

Discussion: We recommend using clinical Pilates exercises in clinics instead of the home exercise program for chronic nonspecific low back pain. The recommendation and application of clinical Pilates by physiotherapists will be beneficial in the treatment plan for patients with CNLBP more.

Keywords

Low Back Pain; Clinical Pilates; Pain Intensity; Disability

DOI: 10.4328/ACAM.20648 Received: 2021-04-13 Accepted: 2021-06-24 Published Online: 2021-07-20

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Introduction

Factors affecting pain severity of nonspecific back pain; sociodemographic characteristics, physical and psychosocial factors, lifestyle, repetitive activities, repulsion and withdrawal activities, static work posture [1,2]. Nonspecific low back, pain caused by pathologies related to the spine, sacroiliac joints, ligaments and paraspinal muscles, dura, spinal cord, and nerve roots is defined as mechanical low back pain [3,4].

Pilates exercises, which have become popular in recent years, strengthen the abdominal back muscles, and contribute positively to the lumbar spine posture. Clinical Pilates is a further modification of this method adapted for therapeutic use concentrating on core muscles [5,6]. In the literature, there are several studies evaluating Pilates but the results are conflicting [7]. Although there is a large number of researches on this subject, a stronger evidence about the effectiveness of Pilates is needed. Strengthening and stretching exercises are widely used in home exercise programs.

The purpose of our study was to examine the effectiveness of clinical Pilates in women with chronic nonspecific low back pain. However, we compared the effects of clinical Pilates training versus home exercise program on pain, muscle strength, pulmonary function, balance ability and disability level in women with chronic nonspecific low back pain.

Material and Methods

Forty women between the ages of 30-45 were included in our study. According to the power analysis, it has been calculated that when 40 people were included in the study (20 people in each group), 90% power would be obtained with 95% confidence. The participants were randomly divided into two groups as Pilates group and a control (home exercise) group. A computer-aided block the randomization method was used for randomization of cases.

Our study was conducted with the approval of Pamukkale University Faculty of Medicine Ethics Committee (60116787\020\44903). Initially, all participants gave written consent. This study was carried out in accordance with the Principles of Helsinki Declaration.

Individuals who have been diagnosed with mechanical low back pain at least 8 weeks ago, who had mechanical low back pain for at least 3 months and female participants were included in the study. Simple analgesia was permitted, but participants were requested to refrain from seeking other forms of treatment during the trial.

The exclusion criteria were pregnancy, radicular back pain, previous spinal surgery, orthopedic and neurological diseases. Before the start of the training, all participants were given a 2-hour training of Back School by the physical therapist. In this training, the anatomy of the lumbar region, muscle structure, neutral spine position, proper lumbar posture, protection methods of the low back during daily works, office ergonomics for individuals with low back pain were discussed.

Participants performed 45 minutes of clinical Pilates exercises with a physical therapist 3 times per week for a total of 8 weeks. Forty cases were divided into two groups as Pilates group (n=20) and home exercise group (n=20). Home exercise program which is widely used in clinics was recommended to the second group.

The participants performed the home exercises in their own homes. To get informed about the continuity of the exercise program, a phone dial was made with the participants once a week. Forty participants completed the study as the clinical Pilates group and the home exercise group. The participants were evaluated before and after the training.

Home exercise program

Home Exercise Program consists of the following exercises:

1. Participant in a hooked position, reaching to the knees with her hands, head raised.
2. Posterior pelvic tilt exercise in the supine position.
3. Stretching the lumbar extensors by pulling the knees to the chest in the supine position.
4. Stretching both hamstring and lumbar extensors by touching the toes with hands in long sitting position.
5. Stretching the hip flexors by springing forward in a half kneeling position.
6. Strengthening the M. Quadriceps femoris by squatting and standing up, in standing position.
7. Strengthening the back extensors while lying down in the prone position with both arms on the sides of the body, asking them to lift their head and upper body backwards [8].

Each exercise was performed with 10 repetitions.

Clinical Pilates program

The 5 key elements, consisting of centering, breathing, head and neck placement, shoulder placement, chest wall placement were taught to the Pilates group before the first session. The Pilates exercise program included warm-up and cool-down exercises, and each exercise was repeated 7-8 times [9].

1. Warm-up (foot series, roll up, chest stretching, upper body warming exercises, upper body series, side plie with stretch, walking)
2. Roll down, Roll down with push up, shoulder bridge, hip twist, abdominal preparation, oblique preparation, breaststroke preparation, swan dive, single leg kick, clam, single leg circle, swimming, arm opening, spine twist
3. Cool down (spine stretch, the saw, mermaid, piriformis stretches, hamstring stretch)

Questionnaires and scales used in the evaluation of participants: Demographic data form: Age, smoking, marital status, number of childbirths, type of childbirth was questioned.

Assessment of pain severity: The Visual Analogue Scale (VAS) was used for the intensity of low back pain [10].

Strength assessment: Participants' trunk flexion, trunk extension, hip flexion, hip extension, hip abduction, hip adduction, knee flexion and extension muscle strength were assessed with digital force meter (Power Track). "Make test" was used as the measurement technique and the maximum power application protocol for the device was used while the meter kept the dynamometer constant. After completing the desired movement, the participant was asked to continue the maximum isometric contraction for 5 seconds. Averages of the 3 consecutive maximum contractions were measured with intervals of 30 seconds [11,12].

Pulmonary function: During the test, forced expiratory flow rate (FEV1%), forced vital capacity (% FVC), FEV1 / FVC] were measured in the first second. During the test, the participant sat down, and his\her nose was closed with a plastic latch. The

patient was asked to breathe very deeply, exhale very quickly and completely, or to hold his\her breath for a short time [13]. Balance Assessment: Static balance was evaluated by flamingo balance test. [14]. The dynamic balance was assessed by functional reaching test. [15].

Observed Oswestry Pain Scale: It consists of 10 items questioning daily life activities. These are; pain severity, personal care, lifting, walking, sitting, standing, sleeping, social life, travel and pain. There are 6 options between 0-5 points for each item. Zero indicates worst case, 5 indicates worst case, 0-14 weak, 15-29 moderate, 30 above the functional limit [16]. SPSS for Windows 22.0 computer package program was used for all statistical analyzes. Descriptive statistical data were given as mean \pm standard deviation (X \pm SD) or %. In all statistics, the p-value was accepted as 0.05. In the study, the Wilcoxon test was used to determine the differences before and after treatment in the study, and the Mann-Whitney U test was used for the differences between the groups [17].

Results

There was no difference between the groups in terms of age, weight, height, body mass index (Table 1). When analyzing pain severity, trunk and lower extremity muscle strength measurements, balance levels and disability levels of the groups, there was no significant difference between the groups ($p > 0.05$). In the clinical Pilates group, when comparing pain severity before and after training, there was a significant decrease in pain severity after training ($p < 0.05$).

When trunk flexor and extensor muscle strength were compared, it was seen that muscle strength significantly increased after the clinical Pilates training ($p \leq 0.05$). Bilateral hip flexion, extension, hip abduction and adduction, knee extension muscle strength were also significantly increased following the clinical Pilates training ($p \leq 0.05$). When the flamingo balance test and functional reaching test results were compared, a significant increase was determined after the training for the clinical Pilates group ($p < 0.05$). There was also a significant decrease on the Oswestry pain scale in participants attending clinical Pilates training ($p < 0.05$) (Table 2).

There was no significant change in the pain severity in the home exercise group, which was measured by the VAS ($p >$

0,05). When measuring the trunk and lower extremity muscle strength, there was no statistically significant improvement in the home exercise group.

Both methods were not superior to each other in the respiratory functionality, although the clinical Pilates FVC results were improved ($p = 0.09$ for FVC; $p = 0.32$ for Fev1 /FVC). There was no significant improvement in balance levels and Oswestry pain scale measurements in the home exercise group ($p > 0.05$).

In our study, we determined that clinical Pilates was more effective than home exercise group in reducing pain severity in patients with mechanical low back pain (Figure 1).

When the clinical Pilates group and the home exercise group were compared, there was a statistically significant increase in measurement results related to the trunk flexion muscle strength of the clinical Pilates group after training ($p < 0.05$). However, intergroup differences were not shown ($p = 0.27$). When clinical Pilates and home exercise training were compared for trunk extension, hip flexion, extension, abduction, adduction, knee extension muscle strength, the clinical Pilates group showed a statistically significant improvement in muscle strength ($p \leq 0.05$).

When the flamingo balance test and the functional reaching test results of both groups were examined, there was a statistically significant superiority compared to the home exercise program of clinical Pilates method. Clinical Pilates training was found to be more effective than home exercise program in improving static and dynamic balance. When the results of the Oswestry pain scale of the clinical Pilates and home exercise program participants were compared, we can say that clinical Pilates is more effective in reducing the level of disability than the home exercise program.

Table 1. Demographic variables of both two groups

Variables	Clinical pilates (n=20) X \pm SD	Home exercise (n=20) X \pm SD	p-value
Age, (year)	41,55 \pm 3,39	38,95 \pm 3,96	0,064
Height, (cm)	162,5 \pm 4,45	161,85 \pm 4,24	0,382
Weight, (kg)	64,14 \pm 7,95	62,7 \pm 5,01	0,816
Body Mass Index, (kg\m ²)	24,25 \pm 2,55	23,9 \pm 2,35	0,597

X: Mean, SD: Standard deviation, *: statistically significant difference, cm: centimeter

Table 2. Comparison of clinical Pilates and home exercise group results

Variables	Clinical Pilates (N=20)			Home exercise (N=20)			Intergroup comparison p value
	Pre training X \pm SD	Post training X \pm SD	p value	Pre training X \pm SD	Post training X \pm SD	p value	
VAS	5,34 \pm 2,5	1,28 \pm 1,6	0,00*	5,7 \pm 1,76	5,7 \pm 1,9	0,77	0,00*
Pulmonary functions							
FVC (%)	100,2 \pm 16,01	108,8 \pm 11,6	0,00*	104,8 \pm 17,2	100 \pm 16,07	0,13	0,09
Fev1\FVC (%)	91 \pm 17,0,1	94,2 \pm 11,4	0,25	91,25 \pm 16,6	90,55 \pm 16,9	0,15	0,32
Balance							
Flamingo test	23,16 \pm 9,4	47 \pm 20,6	0,00*	23,5 \pm 7,2	22,4 \pm 8,2	0,2	0,00*
Functional reaching test	33,9 \pm 6,5	41,5 \pm 3,8	0,00*	33,1 \pm 5,5	32,9 \pm 5,9	0,38	0,00*
Observed Oswestry pain scale	26,4 \pm 14,06	6,2 \pm 6,8	0,00*	26,4 \pm 13,7	26,1 \pm 13,08	0,36	0,00*

X: Mean, SD: Standard deviation, *: statistically significant difference, VAS: Visual analogue scale

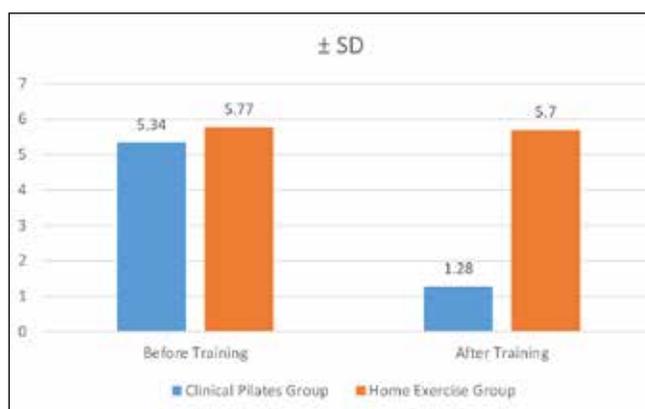


Figure 1. The comparison of pain before and after the intervention for the two groups.

Discussion

Our purpose was that clinical Pilates training in women with chronic nonspecific low back pain would provide more favorable improvements in muscle strength, pain, balance and disability compared to the home exercise program. The purpose of this study was to compare the effectiveness of clinical Pilates program on nonspecific low back pain with an exercise program consisting of flexibility exercises and strengthening abdominal and back muscles, which are commonly used in clinics.

We found a significant decrease in pain intensity in the Pilates group. There was no significant change in pain intensity in the home exercise group. When both methods were compared, it was seen that clinical Pilates more effective than a home exercise program in decreasing pain. The literature review shows that clinical Pilates reduces chronic mechanical low back pain. In a meta-analysis study, Owen et al. stated that Pilates, stabilization\motor control, aerobic and resistant exercise programs are the most effective treatment methods in individuals with chronic nonspecific low back pain [18].

Chronic back pain and muscle weakness developing over time leads to postural disorders. Over time, decreasing in movement and mobility leads to muscle weakness. We think that this situation also negatively affects the balance. Therefore, we think that clinical Pilates exercises have positive effects on muscle weakness and body inhalation in chronic low back pain and should be included in the physical therapy and rehabilitation program.

There was a statically significant increase in the levels of the body and lower extremity muscular strength in the clinical Pilates training group compared to the home exercise group. We can say that the clinical Pilates training is a more effective method than the home exercise program especially for improving hip flexion and extension muscle strength. The clinical Pilates program is a more effective method to improve muscle strength except for body flexion than the home exercise program. However, none of the methods are superior to the other in terms of enhancing body flexion muscle strength. In the Pilates program, a person is worked on by increasing the level of difficulty of movement with his / her body weight and the auxiliary tools used. All the body-oriented exercises are controlled under the supervision of a physiotherapist in the Pilates program, while working individually against body

weight at home in the home exercise program. We think that the difference is caused by this situation. Our study has similar results with the literature. Tozim et al. showed an improvement in the isometric strength of the trunk extensor muscles as evaluated with a lumbar dynamometer when they compared Pilates method with other exercise methods [19].

Roşu et al. investigated the effects of Pilates, McKenzie and Hecksher training on pulmonary function in patients with ankylosing spondylitis. As a result, in their study of 96 participants, it was seen that this training had a positive effect on pulmonary functions [20]. In our research, there was a significant increase in FVC values in the clinical Pilates group, while there was no significant change in Fev1 / FVC values. No significant change in FVC and Fev1 / FVC values was observed in the home exercise group. We can say that clinical Pilates increases vital capacity in participants with mechanical low back pain.

There are a limited number of studies evaluating the static and dynamic balance in patients with nonspecific low back pain in the literature. Yalfani et al found that mat Pilates exercise program had beneficial differences on static balance for chronic low back pain [21]. Its effect on dynamic balance was not statistically significant. In our study, we found significant improvement on static and dynamic balance in patients with chronic low back pain. We need more investigation on Pilates exercises for balance.

In a meta-analysis conducted in 2020, they investigated the effect of Pilates exercises on disability in patients with low back pain. The results of meta-analysis showed that Pilates exercises had a significant positive effect on disability improvement in the Pilates group compared with other types of exercise methods [22]. Another review article suggested that, the Pilates method has demonstrated excellent results in pain perception and intensity, functional capacity, fear of movement, and the idea that movement can worsen the health perception, muscle strength, and flexibility [23].

As a result, it was concluded that Pilates is an effective method on pain and disability, Core weakness is very important in patients with low back pain [24]. Axial extension and stabilization principles are applied throughout Pilates exercises. Studies show that Transversus Abdominis, Multifidus, diaphragm, pelvic floor muscles and abdominal oblique muscles are the muscles which are key to movement in healthy people in terms of low back pain [24,25].

A limitation of this study was that long term effects of exercise programs have not been investigated. The strength of this study was that two exercise programs that affect such parameters as strength, balance, pulmonary functions were investigated in patients with chronic low back pain. Blinded assessments were done by a independent physiotherapist. Both interventions were delivered by the same physiotherapist to minimize differences. This study showed that clinical Pilates exercises are more effective than home exercise program in reducing pain, disability and improving strength, balance for patients with chronic nonspecific low back pain. Physiotherapists should use clinical Pilates exercises in the treatment plans of patients with nonspecific low back pain.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:

Ozden Baskan, Ugur Cavlak, Emre Baskan. Effectiveness of a clinical pilates program in women with chronic low back pain: A randomized controlled trial. *Ann Clin Anal Med* 2021; DOI: 10.4328/ACAM.20648