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The effects of Home Therapeutic Exercise on physical fitness of women with back pain

Fateme Zare Bidoki[1*], Vahid Zolaktaf [2], Gholam Ali Ghasemi [3]
[1*]M. Sc of Physical Education, Faculty of Physical Education, Isfahan University.
Email: fateme.zare.2009@gmail.com
[2]Associate Professor of Physical Education, Faculty of Physical Education, Isfahan University.
[3]Associate Professor of Physical Education, Faculty of Physical Education, Isfahan University.

Abstract: A series of inhibiting factors has led women with back pain to be usually recommended staying in bed rest and be banned especially from sport activities. The aim of this study is to evaluate the effectiveness of a home therapeutic exercise protocol on physical fitness of women with low back pain. The training program included 2 weeks of practical work and training. Then, with phone supervision and guidance for six weeks and using training CD, patients continued exercises at home. Preliminary tests were repeated every two weeks until the end of the program. Test used included standardized tests of physical fitness. Statistical analysis was done through ANOVA for repeated measures by SPSS software. Statistical analysis showed that for all 6 physical factors, there is a significant interaction in favor of the experimental group. According to the results obtained, it can be concluded that home therapeutic exercise with the protocol presented in this study has been effective on improvement of physical fitness. In total, according to the physical benefits of therapeutic intervention used, this approach can be introduced as a valuable therapeutic way to improve back pain patients.
Keywords: *Fitness, exercise therapy protocols, low back pain, exercise therapy, SPSS*

INTRODUCTION

Back pain is a pain that is felt in upper back and lower layers of muscle between the ribs and hip and may be associated with foot pain or not (10).

Prevalence and economic costs: Back pain is one of the most common musculoskeletal problems in developed countries and about 80 percent of the people are infected at least once during their lives (11). Each year, about 15 to 37% of clients referring to specialized treatment centers of musculoskeletal problems are patients with back pain (12).

The population characteristics and complications of the disease: back pain is one of the most common causes of disability and functional limitations of lots of people between the ages of 20 to 45 years (1). However, the back pain occurred, deprives the normal motion and function of the patient. It is why among musculoskeletal disorders, back pain causes the greatest limitation in the workplace and is the second cause of absence from work (13). If severe pressure is not applied to the waist, 90% of back pains are treated spontaneously during a period of three months (15, 14). Common treatments: different treatments are recommended for back pain that include a wide range of methods from modern medicine (drug therapy, surgery) to various methods of complementary alternative therapies (such as

acupuncture, chiropractic, and osteopathy) and physical treatments. Therapeutic effects of this technique are still not well-understood (16). Various treatment methods focus on relieving pain, reducing disability, and returning patients to activities of daily living (17, 18, 19 and 20).

Potential benefits of exercise therapy for the target population: Many studies have shown that people who exercise regularly are less likely to suffer lower back pain (21 and 22). In addition, exercise therapy is one of the most common procedures used widely to treat back pain (22). Exercise therapy is prescribed alone or in combination with other treatments. Clinical guidelines of exercise therapy for chronic low back pain are varied, but their ultimate goal of all the pains is pain relief and improvement of functions of the patients (23, 24 and 25).

Patients with chronic low back pain have weak trunk muscles compared to healthy individuals (26). Positive results of exercise therapy on Chronic Lower Back Pain (CLBP), especially for those who have a weak trunk muscles are proven (27, 28 and 29). The weakness exists in muscle strength, endurance, and flexibility (30).

In the study by Farahpour et al. (2002), reduction of pain and improvement of lumbar flexor isometric forces were seen after 12 sessions of exercise therapy (6). In a study of Bani Gol et al. (2008), decreases in pain and lumbar stabilization were observed after Pilates exercises for six weeks (4).

In the study by Kiani Dehkordi et al., pain reduction and increase in range of motion in the hip joint angle of 56 female patients with low back pain for one year that had gone through twelve sessions of Pilates training session was observed (7). In the study by Bakhtiyari et al. (2004) a significant increase in trunk flexion range, increase in the angle (SLR), and rapid performance of everyday activities (functional improvement of patients) was observed after 4 weeks of exercise protocol in sixty patients with disc herniation (8). In the study by Ghiasi et al (2006), reduction in pain and disability was observed in 34 patients with chronic low back pain after 14 sessions of Williams and stabilization exercises (9).

In the study by Samadi Pour et al. (2008), the effects of three different ways of exercise therapy were studied on pain and disability in patients with chronic mechanical low back pain. The results showed that exercises done in all three groups, with emphasis on muscle strengthening exercises of spine could be effective in reducing pain of the patients. Nevertheless, Williams and McKenzie exercises are always performed in static conditions and strengthen a specific muscle group. However, in stabilization exercise in addition to strengthening muscles in static conditions, their strengthening is done in dynamic conditions as well (10).

Sartipoyerazo et al. (2009) compared the effects of isokinetic and standard exercises in people with chronic back pain. Pain severity, trunk flexion test to evaluate spinal mobility and muscle strength were done in the third week (end of the exercises) and seventh weeks. The results showed that both groups had significant improvement in these variables (38).

2. Research Methodology

Regarding the results, this study is applied one. In terms of the structure, it is quasi-experimental and prospective. In this study, the effect of the independent variable (8-week home exercise therapy) on 6 dependent

variables of physical fitness (general static strength of flexors of the trunk, hip flexors endurance, endurance of the lumbar extensors, general dynamic strength of flexors of the trunk, back and hamstring flexibility, and general endurance) of women with back pain is evaluated. The population was female patients who referred to the orthopedic department of Mehr Yazd hospital of Isfahan with age range of (30-50 years) and back pain for more than three months. Among the patients, the ones willing to participate in pre- and post-test or those naturally not showing high commitment to the program were used as controls, and thus exercise therapy group and exercise therapy groups were formed. Two-week exercise program (three sessions per week) was practical training, then patients with a guide disc corresponding movements in three-phase continued training exercise for two months.

Physical exams were repeated until the end of the program every two weeks, so that based on that, feedback is given to the patients considering their improvements and refinements related to overload.

The study stages in the control group included 1) pre-test, 2) period of two months after the test, 3) and post-test. In the experimental group, we had eight weeks of treatment and three tests. The stages included, 1) Pre-test, 2) two weeks of exercise therapy with the help of trainer, 3) mid-test one, 4) two weeks of exercise therapy with the help of educational CD, 5) mid-test two, 6) two weeks of exercise therapy with the help of educational CD, 7) mid-test three, 8) two weeks of exercise therapy with the help of educational CD, and 9) post-test.

In exercise protocol, the experimental group did exercise for eight weeks, three sessions per week, 30-45 minutes each session. The first two weeks were with the training of the researcher training and following six weeks with the help of CD at home. Training was done in three phases 1, 2 and 3 in three separate CDs given to patients. Performance enhancement was done from a supine position to sitting and standing was in three phases. In designing the selected training of this project, several features had been considered: 1) the main objective is overcoming the hamstring weakness, waist, back, quadriceps, and weak short abs, hamstrings, and calves. 2) in choosing movements, attention is paid to eliminate the root of the problem (depreciation of vertebrae) and the individual is prepared for sleeping, sitting, standing, and walking, 3) engaging deep muscles with fine spin-on, clicking movements, and fine movement, 4) paying attention to the chain integration of joints and action on joints farther from the center of pain in the early phases, 5) starting with open chain and gradual approaching of closed chain (progressive overload), 6) course of objectives : increased range of motion, endurance, strength, balance, and power from a supine position to standing, 7) paying attention to the high level of ability of the individual and that chronic pain should be tolerated and its definite cure is out of reach, and 8) in this research, on the one hand, by calculating compliance coefficient, the practicality of the exercise programs designed for is specified. On the other hand, it is specified that over a period of two months, how much of progress this sport program creates in physical fitness. In case of success of the exercise program, patients could be recommended considering it in their lifestyles. The training protocol details are provided in Appendix CD.

In order to assess the general static endurance of trunk flexors, trunk detract test was used. The subject is asked to stay in the supine position on the bed and hold his lower limbs while the thighs are perpendicular and calves are perfectly horizontal.

In addition, they bent their head and neck forward and place upper limbs on the abdomen. The length of time that a person could hold this status was measured and recorded by timer in seconds by the examiner and considered as general static endurance of trunk flexors (34).

In order to assess the strength of the hip flexors, hip bending test was used. The subjects were asked to stay in the supine position on the bed and two feet in pairs were brought by the examiner at a distance of thirty centimeters from the surface, and then the person was told to hold his legs fix in this area without the help of the examiner. The time of this state was measured by a timer and considered as hip flexors endurance.

In order to assess back extensors endurance, trunk rise test was used. The subjects were asked to stay in a prone position on the bed and place a small pillow under the abdomen and pelvis to reduce lumbar lordosis. Upper limbs on either side of the trunk and palms stay attached to the outside of the thighs. The individuals were asked to keep their head and neck in neutral position to separate sternum from mattresses. Time of holding this status was measured and recorded by timer as the endurance of the lumbar extensors (34).

In order to assess the flexibility of waist and hamstring, sit and reach test were used. The subjects were asked to sit, set the feet in front in verbose mode, and a ruler of the length of 100 cm was placed in the middle of two feet, and 36 cm of ruler was before the toes and the rest were in the front. The subjects were asked to bring their hands in pairs ahead and as far as possible, lean forward, and a number of rulers touched by the fingertips were as the number of the test.

Three separate executive attempts within one minute were done and the best record was considered as the individual's score (35).

In order to assess general dynamic endurance of trunk flexors, half-sitting test was used. The subjects are asked to lie on the bed on his back and knees were bent and placed on the surface and along the legs and they were asked to try to lift up his head until an angle of 45 degrees separates from the earth.

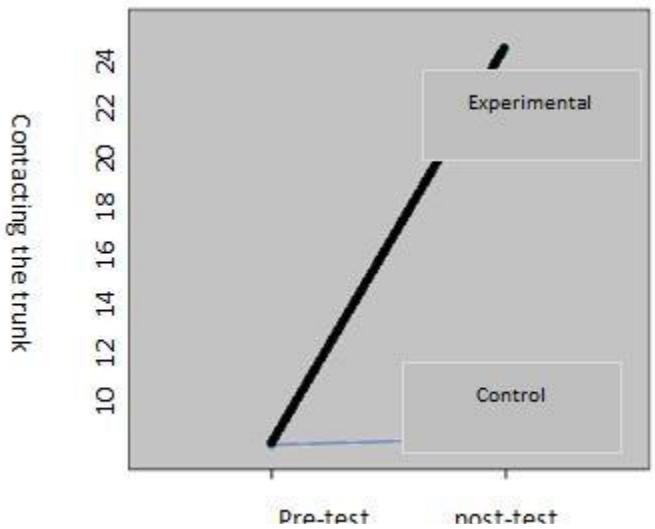
The number of times this is done in one minute was considered as score of subjects (36).

In order to assess general endurance, test of six-minute walk was used, and the participants were asked to travel for six minutes with maximum power, where by tape measure the distance was measured in meters (11).

3. Results and findings:

In this study, there were 6 dependent variables of physical fitness (roll up the trunk, hip bending test, edema, trunk, trunk standing, half-sitting, sit and reach, and walk), and the effect of a period of home training program on them was assessed. Within group element of the research were two tests (before and after the exercise period).

Inter-group elements were operating classification based on participation and non-participation in training courses during 8 weeks of exercise. Accordingly, research had one experimental group (n = 14), and a control group (n = 15). For each of the 6 variables of physical fitness, an analysis of variance for repeated sizes was conducted.



Figur Pre-test post-test **imes**

Description of Figure 1-4: Total time of contracting the trunk in experimental and control groups in the pre-test, respectively, were 10.1 and 10.1 seconds. In the post-test, time of contracting the trunk in experimental and control groups were, respectively, 24.3 and 10.3 seconds. In the analysis of variance for repeated data, the most important measure is to compare changes in interaction (slope of change lanes in research groups). If this comparison is significant, there is no need for any comparison study. In Figure 4.1, it is seen that the slope of the experimental group is quite different from the control group. This difference is statistically significant (F (1 and 27) =83.0 and P=0.000).

The result: in training period, the experimental group has had 140% progress in contracting the trunk, while the control group had only 2 percent. The general conclusion is that exercise therapy can improve trunk contracting.

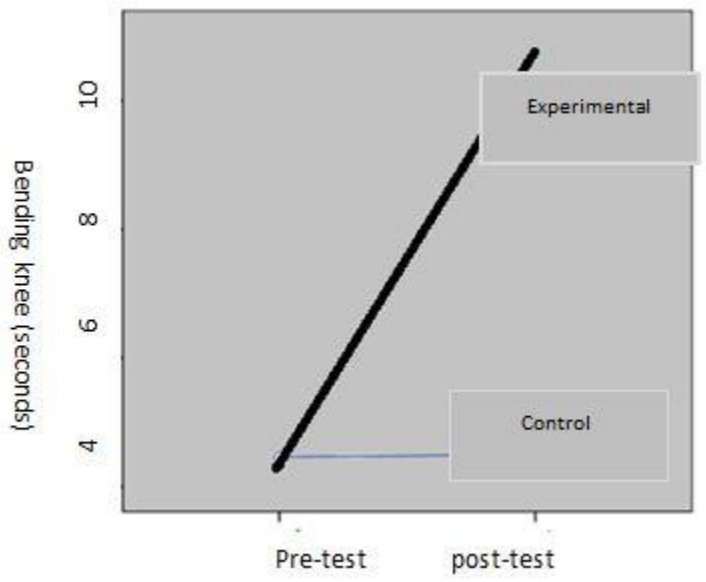


Figure 2: line graph of changes in bending knees in 2 tests

Description Figure 4-2: The time of bending the knees in experimental and control groups were, respectively, 4.3 and 4.5 seconds in the pre-test. In the post-test, the time of bending the knees in experimental and control groups were, respectively, 10.7 and 4.5 seconds. As comparison of interactive changes (slope of change of lanes in research groups) has a significant difference, there is no need for comparison. In Figure 4-2, it is seen that the slope of the experimental group is quite different from the control group. This difference is statistically significant (F (1 and 27) =152.7 and P=0.000).

Result: in training period, the experimental group has had 148% progress in bending knee, while the control group had no progress. The general conclusion is that exercise therapy can improve bending knee.

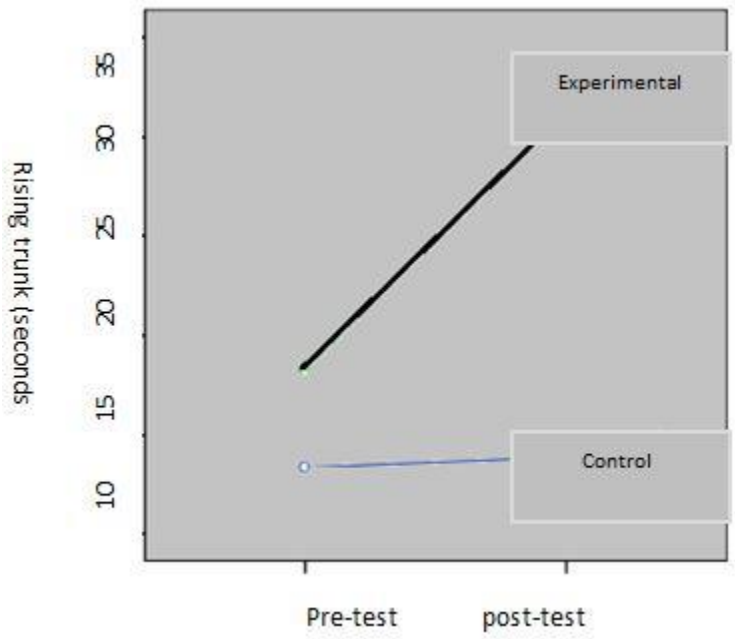


Figure 3: line graph of changes prone trunk in two test sessions.

Description of Figure 4-3: trunks rise time in the experimental and control groups in the pre-test were 18.3 and 13.4 seconds respectively. In the post-test, trunks rise time in the experimental and control groups in the pre-test were 13.9 and 31.3 seconds respectively. With regard to the comparison of interactive changes (slope change in lanes of research groups), there is a significant difference, and no need to compare the others.

In Figure 4-3, it is seen that the slope of the experimental group is quite different from the control group. This difference is statistically significant (F (1 and 27) =22.9 and P=0.000).

Result: in training period, the experimental group has had 71% progress in trunk rise, while the control group had 4%. The general conclusion is that exercise therapy can improve trunk rise.

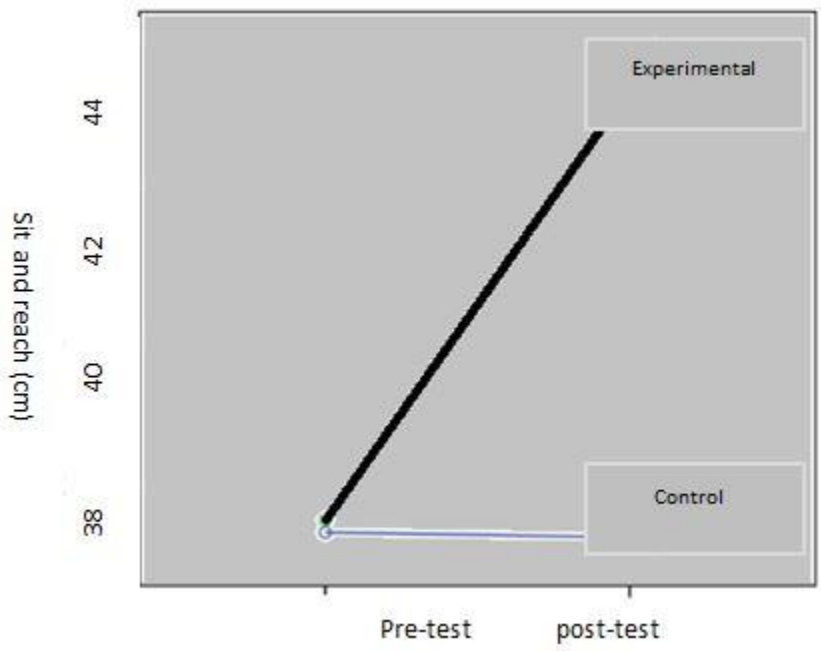


Figure 4: line graph of sit and reach test in two test sessions

Description Figure 4-4: sit and reach test of the experimental and control groups, respectively, were 37.5 and 37.3 seconds in the pre-test. In the post-test, sit and reach test of the experimental and control groups, respectively, were 43.4 and 37.3 seconds. With regard to the comparison of interactive changes (slope change in lanes in research groups) there is a significant difference, and no need for other comparison. In Figure 4.4, it is seen that the slope of the experimental group is quite different from the control group. This difference is statistically significant (F (1 and 27) =542.5 and P=0.000).

Result: in training period, the experimental group has had 16% progress in sit and reach, while the control group had none. The general conclusion is that exercise therapy can improve sit and reach test.

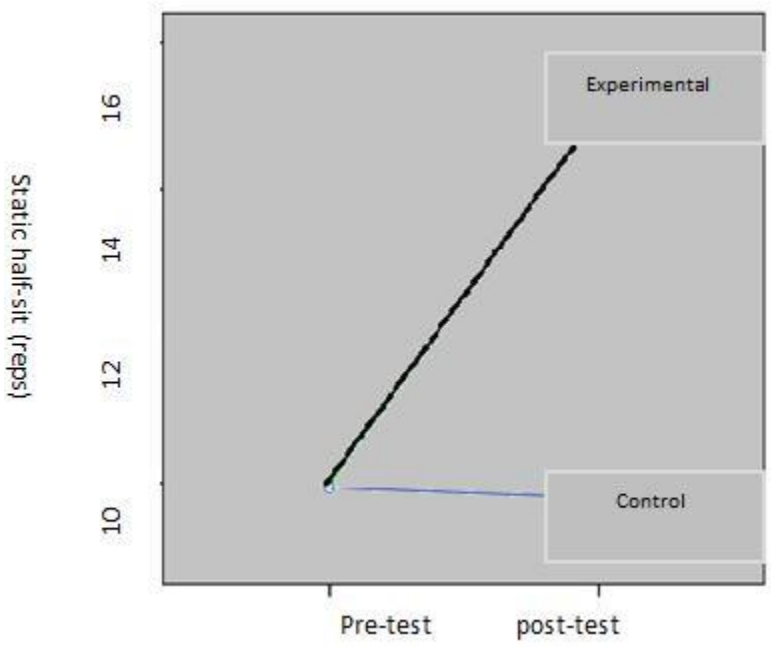


Figure 5: line graph of the changes in the static half-sit of the trunks in in two tests

Description of Figure 4-5: test scores of static half-sit in the experimental and control groups in the pre-test were respectively 10 and 9.93 seconds. In the post-test, test scores of static half-sit in the experimental and control groups in the pre-test were respectively 15.1 and 9.8 seconds. With regard to the comparison of interactive changes (slope change in lanes in research groups) there is a significant difference, and no need for other comparison. In Figure 4.5, it is seen that the slope of the experimental group is quite different from the control group. This difference is statistically significant (F (1 and 27) =214.8 and P=0.000).

Result: in training period, the experimental group has had 51% progress in static half-sit, while the control group had 1%. The general conclusion is that exercise therapy can improve static half-sit.

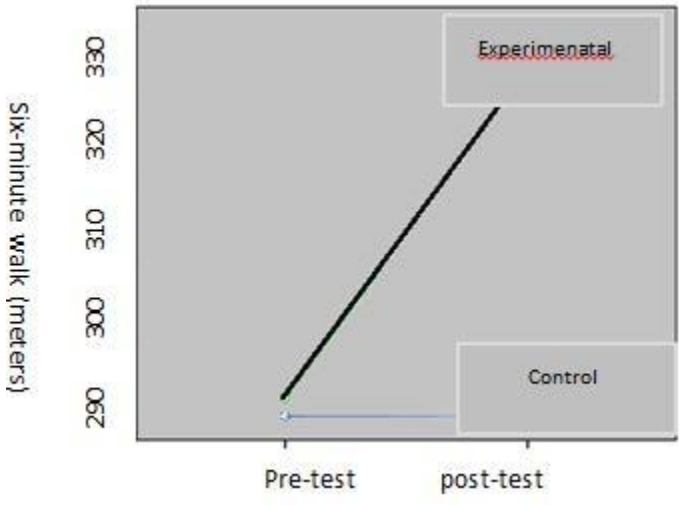


Figure 6: line graph of 6-minute walk test changes in two tests

Description of Figure 4-6: The 6-minute walking test scores in experimental and control groups were, respectively, 292.6 and 290.3 m in the pre-test. In the post-test, 6-minute walking test scores in experimental and control groups were, respectively, 335 and 290.2 m. With regard to the comparison of interactive changes (slope change in lanes in research groups), there is a significant difference, and no need for other comparison. In Figure 4.6, it is seen that the slope of the experimental group is quite different from the control group. This difference is statistically significant (F (1 and 27) =298.7 and P=0.000).

Result: in training period, the experimental group has had 14% progress in 6-minue test, while the control group had none. The general conclusion is that exercise therapy can improve 6-minue test.

Table 1: Summary of analysis of variance of the repeated data

ELEMENT	GROUP	PRE-TEST	POST-TEST	DIFFERENCE	F AND P VALUES DIFFERENCES		
		SD±MEAN	SD±MEAN		Intergrou df (27 and	Interaction df (27 and 1)	Intra-group df (27 and 1)
RUNK CONTRACT (SECONDS)	8.6 000)	88.6 0.000)	88.6 (0.000)	88.6 .000)	88.6 000)	88.6 (0.000)	88.6 (0.000)
Bending knee (SECONDS)	(0.000)	.6 (0.000)	.6 (0.000)	6 (0.000)	6.6 (0.000)	6.6 (0.000)	56.6 (0.000)
RISING TRUNK (SECONDS)	6.6	26.6	26.6	26.6	6.6	26.6	26.6
SIT AND REACH CM	000)	0.000)	(0.000)	.000)	(0.000)	(0.000)	(0.000)
HALF-SIT REPS	18.3 000)	518.3 0.000)	518.3 (0.000)	18.3 .000)	518.3 000)	518.3 (0.000)	518.3 (0.000)
WALKING							

(METERS)	ntrol	8 ± 290.3	0.2 ± 21.1	0.25-			

SD: STNDARD DEVIATION, DF degrees of freedom

4. Discussion and conclusion

Hip flexor muscles are one of the determinants of lumbar lordosis arch. These are the muscles of the pelvic connection and their weakness or shortness heavily affects pelvic position. Shortness of hip flexors causes pelvis to lean forward and their weakness leads to hips back strain. Our training program focuses on both Strengthening and flexibility of these muscles. Therefore, endurance training has been used in order to prevent the pelvis from leaning forward, which increases arc lumbar lordosis. Abdominal exercises intended to strengthen the abdominal muscles, also strengthened IPA muscles. On the other hand, our training program also included proper stretching exercises for hip flexors to prevent their shortness and smooth arc lumbar lordosis. Lumbar extensors were also strengthened so that all the muscles in the back are strengthened and there is also an increase in the stability of the spine (2, 5, 31, 32, and 33). Spinal mobility in patients with chronic low back pain is then decreased. The waist and hamstring muscle tightness is one of the main reasons behind back aches. In the case of their shortness, stretching these muscles is a recommended practice. Therefore, it is recommended to measure the spinal mobility of these patients so their performance can be determined.

This study measured hip flexors endurance by hip bending test, trunk extensors endurance by trunk edema test, lower back and hamstring flexibility by the sit and reach test, general endurance of dynamic stochastic trunk flexors by Shaft Deflection Test and general endurance test by 6-minute walk. The results of the study revealed that hip flexors endurance in the period after training in the experimental group had a significance increase. However, no significant increase was observed for the control group. This finding confirms the effectiveness of home exercise therapy designed for the physical fitness. The results of this study are in line with those from Sertpoyrazu et al. (2009), and Samadipour et al. (2000). Sertpoyrazu et al. (2009) compared isokinetic and standard training exercises in patients with chronic low back pain. Pains, trunk flexion test to evaluate spinal mobility and muscle strength were assessed in the third week (finish) and seventh week. Their results showed that both the groups had significant improvement in these variables. Samadipour et al. (2000) studied three different methods of exercise therapy on pain and disability in patients with chronic mechanical low back pain. The results show that exercises conducted in all three groups, with a focus on strengthening exercises for spine muscle can be effective in decreasing the pain in patients (10). However, Williams and McKenzie exercises are always performed in static conditions and strengthen a specific muscle group. But in the stabilization exercises, in addition to strengthening the muscles in static conditions, they are also strengthened in dynamic conditions.

The analysis of physical fitness showed that our home trainings effectively strengthened the physical fitness factors in question. Logical analysis performed on each physical agent also showed that how strengthening the aforementioned factors can help stability and correction of joints stretch in waist line.

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