Advances in Bioresearch
Adv. Biores., Vol 7 (1) January 2016: 133-138
©2015 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
ICV Value 8.21 [2014]

Advances in Bioresearch

ORIGINAL ARTICLE

The Effect of Pilates and hydrotherapy on Movement Range and Pain intensity in non-specific chronic low back pain

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ABSTRACT

This research aimed to study the effects of Pilates and hydrotherapy exercises on range of movement and pain intensity in chronic low back pain (LBP) in 30-50 year-old women. The statistical population consisted of 69 patients who suffered from chronic LBP and volunteered to take part in the study. Forty-seven of them who satisfied the conditions for entering the research were selected and randomly divided into two groups: 24 in the hydropathy group and 23 in the Pilates group. The subjects were evaluated using pretest and post-test of Modified-Modified Schober Test and the Visual Analog Scale, and were treated for six weeks using Pilates and hydropathy exercises under the supervision of trainers. Data collected from pre-test and post-test was analyzed using dependent t-test and one-way ANOVA employing Gain Score analysis (the extent of changes produced from the pre-test to the post-test in each group or the differences between the means) Considering the scores in the pre-test (4.76) and post-test (1.46), pain intensity in the Pilates group decreased more compared to the hydrotherapy group, indicating there were significant differences between these two groups. Pilates was more effective than hydropathy on movement range of the spine in the bending forward movement in patients suffering from non-specific low back pain. However, in the bending back movement, hydropathy was better compared to Pilates (p>0.05). Both hydropathy and Pilates could singly reduce pain intensity and improve movement range, but Pilates was more effective than the hydropathy method.

Keywords: *Hydropathy, Pilates, non-specific chronic LBP, movement range, pain intensity*

Received 01/08/2015 Accepted 28/11/2015

How to cite this article:
Mansoureh S N, Yahya S, Alireza R, Nahid S N, Eizadi M. The Effect of Pilates and hydrotherapy on Movement Range and Pain intensity in non-specific chronic low back pain. Adv. Biores., Vol 7 [1] January 2016: 133-138. DOI: 10.15515/abr.0976-4585.7.1.133138

INTRODUCTION

Non-specific chronic low back pain (LBP) is one of the reasons for the disability of people in developed countries [1]. LBP is the most prevalent form of chronic pain, and that is why it is considered one of the most important reasons for disability in active populations [2], and also one of the most common and most expensive musculoskeletal diseases in societies today [3]. Controlled body movements become difficult because of pain, and pain intensity during the day causes various degrees of difficulty in performing activities such as bending or standing up [4].

Specific causes of LBP are uncommon and, pathologic-anatomic diagnosis cannot accurately determine the reasons for the occurrence of this disease in about 85% of the cases. Non-specific LBP can be

described as strain, pain, and/or stiffness in the lower back region the reason for which is not clear, and which usually causes loss of function and is followed by limited social activities [5].

Motion therapy is one of the most common methods of treating LBP, and patients can use it singly or together with other methods [6]. In this relation, hydropathy, which is usually used for patients with neuromuscular pain, refers to pool therapy, hydrotherapy, or balneotherapy. Heat and buoyancy in water affect temperature receptors and block pain receptors through applying positive effects on the mechanisms of the different parts of the spine. Warm water can help increase blood flow, excrete allogenic chemical materials, and reduce muscle strain. Finally, the hydrostatic effect of water can reduce pain through reducing peripheral edema and by activating the sympathetic nervous system [7].

The Pilates method strengthens muscles and can be considered an effective physical method for treating LBP. Joseph Pilates introduced this method during World War I, and then a new viewpoint was created in rehabilitation [8].

Studies have mentioned changes in the size of the waist curve, weakness of abdominal muscle, weakness of posterior back muscles, weakening of hip extensor muscles, and shortening of hip flexor muscles as the main causes of LBP [9].

This research studied the effects of hydrotherapy and Pilates on non-specific LBP. We hope that its results can be used by people suffering from LBP at hydrotherapy, physiotherapy, and rehabilitation centers, and that they can probably be employed in planning programs related to the health of people with LBP and in finding cost-effective, easy, and applied methods for treating these people.

MATERIAL AND METHODS

This research studied the effects of hydrotherapy and Pilates exercises in treating chronic non-specific LBP in 30-50 year-old women referred to physiotherapy clinics and infirmaries located in several parts of Karaj and Tehran in 2014. Convenient sampling was used to select 30-50 year-old women suffering from non-specific chronic (mechanical) LBP from among 69 volunteers. The orthopedic specialist received the inclusion and exclusion criteria to consider them when visiting the patients. Of course, in the questionnaires related to these criteria, the volunteers were asked questions in addition to background information to make sure they met the requirements for entering the study.

Inclusion criteria: patients with chronic pain of average intensity, 30-50 years of age [10], who were suffering from LBP for which their doctors could find no specific cause in clinical examinations and diagnostic radiography [11]. Their LBP had lasted more than three months and was successively reported [12], but they enjoyed general good health and had no diseases such as hypertension, diabetes, respiratory diseases, or any disease that the doctors thought would make the exercises dangerous for them [10]. Exclusion criteria: people with severe depression, those who were not able to submit their informed consent for entering the study or take part in the interviews due to psychiatric or medical problems such as dementia [13], were excluded from the study. So were patients with numbness and suffering from reduced muscle power who probably had urinary incontinence (that indicated the presence of cauda equine syndrome) [10], had a history of spinal surgery [11], felt pain in the spinal region together with fever and chills, morning stiffness, etc. that suggested the presence of infectious spondylopathy, malignancy, or inflammatory diseases [14]. Those with compressive fractures resulting from osteoporosis, narrow canal and spondylolysis or spondylolisthesis, or fracture in the spine indicating osteoporosis or other diseases [11] while pregnant women [11], and patients suffering from pain that extended towards their feet, which usually does not occur in mechanical LBP [15], were also excluded from the study.

Twenty-two of the 69 volunteers did not satisfy inclusion criteria because they had undergone lumbar disectomy, suffered from post delivery pain, or could not fit the treatment schedule into their daily routines. Common physiotherapy treatments were recommended for these people. An orientation session was held for the participants, and they received a written form that included general information regarding the research and its stages and, if they were willing to participate in the study, signed the consent form and marked the VAS. The researcher then measured their range of motion in the low back region. Following that, they were randomly divided into two groups: 24 with the mean age of 40.67± 8.20 years and BMI of 27.96± 3.91 in the hydrotherapy group, and 23 with the average age of 39.67±9.72 years and BMI of 26.27±3.76 in the Pilates group.

Twenty-one participants in the hydrotherapy group and 18 in the Pilates group completed the six-week hydrotherapy and Pilates programs. The hydrotherapy program was performed in a 1.20 m deep pool with water temperature of 28-30˚C. Each three weekly session lasted 60 minutes and included warming up (10 min.), the main program (40 min.), and cooling down (10 min.). There were 20 sessions to make up for absences and the participants were exempted from two sessions during their menstruation period.

Hydrotherapy exercises included walking through water, the bicycle exercise, walking transversely in water, walking on heels, walking with long steps, kicking, hopping, jumping with both feet, side walking, and jogging [17]. These were followed by actively bending and straightening the spine, stretching exercises for the trunk- lateral bending from standing position: standing lateral stretch, and standing piriformis stretch. And strength training included straightening the neck, tilting the pelvis, rotation both ways and downward by a floating object, bending the knee into the chest, reaching the knee with the elbow, bending towards the thigh, bending the knee while turning, hanging side twist, and swimming while holding on to the edge of the pool [18, 19].

Pilates exercises included 19 training sessions three times a week, the participants were allowed to be absent for only one session, and the 13th session was for people who had been absent in one session. The exercises included the Hundred motions, the roll up exercise, the roll over exercise, the one leg circle exercise (in both directions), the single leg stretch exercise, the double leg stretch exercise, the spine stretch forward exercise, the saw exercise, and the spine twist exercise [20, 21].

The tool for collecting data included measuring movement range, and two independent studies were conducted on healthy people to evaluate repeatability of the objective criteria; that is, changes in the lumbar range of movement. Sixty healthy volunteer women with no history of LBP and with the age range of 30-50 years were tested in three stages to determine the repeatability of the tester in carrying out the Modified- Modified Schober test [22]. The first two stages were for determining repeatability within a day at one-hour intervals, and the third stage for repeatability between days one week apart. An non-elastic cloth meter and a setsquare were used to measure the extent of bending forward, backward, and sideways. The Visual Analogue Scale (VAS) was employed to assess the level of LBP. This criterion is a 10-cm (or 100-mm) line one end of which is marked zero (no pain) and the other 10 or 100 (maximum possible pain). Patients were asked to specify the level of their pain using this line [24].

Descriptive statistics were used for statistical description and analysis of the values of the dependent variables in the pre-test and post-test for each of the two groups. The dependent t-test was performed using the Gain Score technique (the degree of change produced from the pre-test to the post-test in each group or the differences between the means) to analyze the data. After calculating the extent of changes in the mentioned hypotheses, the degrees of change in each variable in the two groups were compared using one-way ANOVA. All calculations were made using SPSS 19 at the alpha significance level of 0.05.

RESULTS

Characteristics of the subjects including age, height, weight, BMI, and the number of children born by each woman were determined and recorded separately for the two groups, and descriptive statistics related to the values of dependent variables in the pre-test and post-test are presented for both groups. Since results of Kolmogorov-Smirnov test in the pre-test and post-test were not significant for any of the groups ($p>0.05$), and because results of the Levine test did not show homogeneity of variance in the two groups, the dependent t-test was used to analyze the data. In most cases, there were significant differences between the variables related to the two groups in the pre-test. However, the homogeneity of the linear relationship between the pre-test and the post-test (regression homogeneity) and homogeneity of variance for the two groups were was not the same. Therefore, we could not use inter-group ANCOVA with a random intervening variable (the pre-test) to homogenize the groups. Therefore, the data was analyzed using the Gain Score technique (the degree of changes produced from the pre-test to the post-test for each group or the difference between the means). In this technique, the degree of changes in the variable of interest is obtained by calculating the difference between the post-test and the pre-test.

Descriptive results show that the means of pain intensities were 4.67 and 5.47 in the Pilates and hydrotherapy groups, respectively, which means the level of pain in the subjects was average. Pilates exercises influenced pain intensity in patients with LBP, and affected the pre-test and post-test of these patients ($t17=8.860$, $p= 0.000$). Results of the dependent t-test for comparison of the levels of LBP in the subjects before and after hydrotherapy exercises show that the changes in this indicator before and after the exercises were significant ($t20=18.072$, $p= 0.000$), and that hydrotherapy was effective in reducing pain intensity in the patients. Results of one-way ANOVA indicate that there were significant differences between the degrees of changes in pain intensity in the Pilates and hydrotherapy groups ($F2, 53=21.15$, $p=0.000$). The degrees of pain reduction were -3.03in the Pilates group and -2.76 in the hydrotherapy group, which shows pain intensity decreased after hydrotherapy. However, pain reduction after Pilates exercises was greater compared to hydrotherapy exercises (and this difference was statistically significant).

Table 1: Mean and SD of pain intensity for each group and their respective follow-up tests

Intervention	Pre-test	Post-test	Change range
Pilates	4.67 ± 1.41	1.64 ± 1.50	- 3.03 ± 1.44
Hydrotherapy	5.47 ± 1.54	2.71 ± 1.82	- 2.76 ± 0.70
	F2,53 = 7.078, p = 0.002		F2.53 = 21.15, p = 0.000

Results of the dependent t-test for comparison of movement range of lumbar vertebrae in the hyperextension movement of the subjects before and after Pilates exercises suggest that the change in this indicator before and after Pilates exercises was significant (t17=3.469, p= 0.003). Moreover, results of the dependent t-test for comparison of the movement range of lumbar vertebrae in the hyperextension movement of subjects before and after hydrotherapy exercises show the change in this indicator before and after hydrotherapy exercises was significant (t20=6.673, p=0.000). Therefore, the hypothesis that the effects of Pilates and hydrotherapy exercises on movement range of lumbar vertebrae in the hyperextension movement in non-specific chronic LBP are different is confirmed.

Table 2: Mean and SD of motion range in the lumbar spines in hyperextension for each group and their respective follow-up tests

Intervention	Pre-test	Post-test	Change range
Pilates	1.64 ± 0.74	2.28 ± 0.63	0.59 ± 0.72
Hydrotherapy	1.42 ± 1.04	3.48 ± 0.87	2.05 ± 1.41
	F2,53 = 14.788, p = 0.000		F2,53 = 3.493, p = 0.038

Results of the dependent t-test for comparison of the movement range of lumbar vertebrae in the flexion movement of subjects before and after Pilates exercises show that the change in this indicator before and after Pilates exercise was significant (t17=5.983, p=0.000). The degrees of changes in the movement ranges of the lumbar vertebrae in the flexion movement were 1.31 and 1.03 in the Pilates and hydrotherapy groups, respectively. Therefore, movement range of lumbar vertebrae in the flexion movement increased, and this increase was the same in the two groups. Therefore, the hypothesis that the effects of Pilates and hydrotherapy on movement range of lumbar vertebrae in the flexion movement in non-specific chronic LBP are different is rejected.

Table 3: Mean and SD of motion range in the lumbar spines in flexion for each group and their respective follow-up tests

Intervention	Pre-test	Post-test	Change range
Pilates	4.91 ± 0.99	6.22 ± 1.00	1.31 ± 0.93
Hydrotherapy	3.50 ± 1.12	4.52 ± 0.84	1.03 ± 1.00
	F2,53 = 1.135, p = 3.329		F2,53 = 6.980, p = 0.000

DISCUSSION

This research showed that exercise therapy was very effective in treating patients suffering from chronic LBP, but there is no evidence yet to show there is a superior exercise to be recommended for patients with non-specific chronic LBP. However, results of employing exercises by experts confirm use of a specific type of exercise is more effective than the rest. Therefore, selection of specific exercises enjoys a special status in research (23). Recently, attention has been drawn to exercises that activate stability muscles. Results of this study indicate Pilates exercises reduced pain intensity, increased the ranges of flexion and hyperextension movements in patients afflicted with non-specific chronic LBP, and decreased pain intensity from 4.67 in the pre-test to 1.64 in the post-test, all of which are considerable changes.

Our results conform to those found in research conducted by Wajswelner *et al*. [26], Posadzki *et al*. [27], and Menacho *et al*. [28] who stated that Pilates exercises were effective in treating chronic LBP through improving the power and movement of the spine. Moreover, our results even show that, based on the VAS questionnaire, Pilates exercises were more effective in reducing pain intensity compared to hydrotherapy exercises.

Results of this research indicate that a period of hydropathy influenced non-specific chronic LBP; that is, pain intensity in the pre-test was significantly different from that in the post-test. In other words, hydropathy reduced pain intensity. Hydropathy affects movement range of lumbar vertebrae in patients with LBP. There were statistically significant differences between hyperextension movements in hydropathy exercises compared to Pilates exercises so that, probably due to the massaging property of

water, spinal spasms were less frequently observed in hydrotherapy exercises and these movements were performed better. The reason for this is that hydropathy increases blood flow, reduces muscle tone, decreases the frequency of spasms, improves the morale of patients, and increases movement ranges of joints, which leads to reduced pain and improved movement range.

CONCLUSIONS

Hydrotherapy and Pilates exercises were effective in significantly reducing pain intensity and increasing movement range. It seems that if these two methods are used simultaneously, there will be greater improvement in the range of movement, but more research must be carried out to prove this. The small number of subjects, lack of cooperation in most treatment centers and the small number of patients referred to them, limiting the research to 30-50 year old women, and the small number of exercise sessions were among the limitations of this study. We suggest that future research should be conducted in a better- controlled environment using various kinds of psychological and physical tests to produce definitive hypotheses in bigger populations. Results obtained after the exercises show hydrotherapy and Pilates can be useful methods for improving non-specific chronic LBP.

ACKNOWLEDGEMENTS

Authors of this research express their gratitude to all personnel and managers of the Women's Park in Karaj for cooperating with us in holding Pilates classes in this Park Complex, and to the Mehrdad Sports Complex for holding hydrotherapy classes in the pool at this Complex. We would also like to thank the doctors and personnel of the Arman Iran Clinic physiotherapy center for their cooperation in making the required measurements.

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