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The effect of water exercise program on Knee osteoarthritis in middle-aged MEN

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Abstract

Osteoarthritis is the most common joint disease, and it is accompanied by progressive joint degeneration. Drug and non-drug treatments have been proposed for treating this disease. The non-drug treatments often start with exercises. Therefore, the purpose of this research was to study the effects of water exercises on knee osteoarthritis in middle-aged men. Thirty of the patients who had been referred to the Shariati and Loghman-e Hakim Hospitals and satisfied the requirements for participating in the research, and volunteered to take part in it, were selected and randomly divided into the exercise and the control groups. The exercise group exercised in water three sessions a week for 8 weeks with specified intensity and duration in each session. After the 8-week exercise training, pain intensity, range of motion, and motor function of the knee joint in the exercise group were measured. Results of the independent t-test showed that water exercise had significant effects ($p \leq 0.05$) on pain intensity, range of motion, and motor function of the knee joint in the exercise group. Therefore, it seems water exercise can improve knee osteoarthritis and reduce disability and clinical symptoms in middle-aged men.

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Introduction

Osteoarthritis is one of the most common diseases of the musculoskeletal system (Silva *et al.*, 2007). This disease causes more disability and more clinical symptoms in the knee joint compared to the other joints, and it is known as one of the factors threatening peoples' health in the world (Deyle *et al.*, 2005).

Studies have shown prevalence of knee osteoarthritis as a factor causing musculoskeletal pain in people 65 years old or older is 60 to 90% (Williams *et al.*, 2006). This disease is one of the main reasons for the dysfunction of the knee and greatly influences people's lives (including their mobility, independence, and daily activities), and leads to restricted recreational, sports, and vocational activities (Salavati *et al.*, 2008). Excessive pressure on, overuse of, and traumatic injuries to the joints are among the reasons for their injury and erosion and for the development of osteoarthritis (Joseph *et al.*, 1997). Other factors are also involved in this disease such as genetics, being female, old age, and obesity (Sinusas, 2012). Treatment methods for osteoarthritis include non-drug and drug treatments, complementary medicine, unconventional medicine, and surgery (Sinusas, 2012).

In general, the safest and least invasive treatment methods should be used first before the invasive and costly ones. Therefore, all patients should receive minimal non-drug and drug treatments, and surgical procedures be performed if their condition does not improve.

Non-drug treatments often start with exercises and many studies have shown that exercises reduce inflammatory arthritis pain (Resende *et al.*, 2008). Research has indicated that, contrary to previously held opinions, strengthening weak muscles such as quadriceps femoris and hamstring muscles prevents the disease or its progression (Bosomworth NJ., 2009). Moreover, it has been established that regular exercise programs increase body flexibility, power, and stamina and improve body performance without exacerbating arthritis or joint abnormalities (Resende *et al.*, 2008). However, some studies have not reported any effects of exercises on osteoarthritis (Hootman *et al.*, 2003).

Nonetheless, it is not clear if various types of exercise have different effects on knee osteoarthritis; and if future research proves a special type of exercise can improve knee arthritis, this finding may be important for people who are exposed to this disease. Therefore, considering the definitions that have been introduced concerning the effects of various types of exercises, it is necessary to test a comprehensive protocol that can be easily implemented and is companied by minimum side effects. As was previously mentioned, knees are deformed in people with arthritis and these people feel great pain when they bend their knees because this causes cramping and tightness in the hamstring and the quadriceps femoris muscles. Therefore, an exercise protocol should be studied in which stretching the hamstrings, strength training of the quadriceps femoris muscle, and isometric exercises without lifting weights are included. Although various methods of training exercises are effective in treating knee joint osteoarthritis pain, the effects of a treatment protocol that includes stretching and strength-training exercises in water have not been sufficiently studied in Iran yet.

Materials and methods

Two hundred patients with arthritis referred to the Rheumatology Centers and the Physiotherapy Wards at the Shariati and Loghman-e Hakim Hospitals were invited to participate in the research by posting advertisements and by holding interviews. Thirty of these 200 patients, who were diagnosed with knee osteoarthritis by doctors and who were willing to participate in the research, were selected. They were divided randomly into the water exercise and control groups. The selected subjects had no history of knee surgery, did not exhibit any secondary osteoarthritis symptoms (secondary osteoarthritis includes diseases that result in osteoarthritis), and did not take any

special medicine. Both groups were pretested first by using the Western Ontario Mc Master index (WOMAC) questionnaire that measures the range of motion, pain intensity, and motor function of patients. The exercise group then carried out an 8-week water exercise under the supervision of the researcher and a hydrotherapy instructor based on a predetermined exercise plan. At the end of the training period, information similar to that of the pretest was collected from both groups.

The Water Exercise Protocol: The 8-week training consisted of three weekly sessions, each lasting 30 minutes with 40% of the maximum heart rate reserve during the first week and 70 minutes with 60% of the maximum heart rate reserve during the last week. Every week, five minutes were added to the exercise session duration. In every session, five minutes of warm up and 5 minutes of cool down activities were included. Each water exercise session included walking in different directions and in different positions in the water, doing stretching exercises (5-8 repetitions each for 10-20 seconds) and strength training exercises for strengthening the muscles in the lower organs or muscles attached to the knees (8-12 repetitions).

Osteoarthritis Evaluation: The WOMAC questionnaire, which assesses pain, joints' range of motion, and motor function of people in different positions, was used to evaluate osteoarthritis. In this questionnaire, pain, range of motion and motor function are given scores of 0-20, 0-8, and 0-68, respectively. The higher the scores are, the more intense the pain, the more restricted the range of motion, and the more limited the motor function will be.

Statistical Analysis

After using the Kolmogorov-Smirnov and the Levene tests to confirm normal data distribution and data homogeneity, respectively, the independent t-test was performed to investigate the effects of the exercises on the dependent variables. All statistical operations were carried out by SPSS and the level of significance of the tests was $p \leq 0.05$.

Results

Research Findings: Table 1 shows the features of pain, range of motion, and motor functions, and the level of significance of the subjects in the pretest and posttest exercise. Research findings indicated that pain, range of motion, and motor function in the two groups were significantly different (p= 0.000).

Table 1. Pre and post-test Pain, Range of Motion and Motor Function variables and t test in the two groups.

Group / Index	Water training		Control		P
	Pre test	Pos test	Pre test	Pos test	-
Pain intensity Knee	16.13 ± 0.68	16.13 ± 0.68	16.12 ± 0.67	16.35 ± 0.69	0.000*
Range of Motion Knee	57.13 ± 2.11	39.06 ± 3.23	57.33 ± 2.31	57.69 ± 2.35	0.000*
Motor Function Knee	6.89 ± 0.89	5.34 ± 0.48	6.43 ± 0.67	6.15 ± 0.58	0.000*

Data are expressed as mean and standard deviation.

Discussion

Osteoarthritis is the most prevalent joint disease and the most important factor in causing chronic disability that leads to heavy direct and indirect costs for the society. Therefore, it has gained great importance as a public health problem. Nowadays, osteoarthritis is no longer considered a degenerative disease resulting from joint erosion but as a disease caused by an active biomechanical, biochemical, and cellular phenomenon (Naji *et al.*, 2011). Therefore, any treatment that can prevent the occurrence of this disease, or reduce its complications, will be quite welcome and useful. One of the factors that have been of interest in various numerous studies is the effects of sports and regular and continuous physical exercises on improving knee osteoarthritis diseases (Lord *et al.*, 1996).

Based on this, the effects of an 8-week water exercises program on knee osteoarthritis in middle-aged men were investigated in this research. Results of the study showed that water exercises led to significant pain reduction and increased range of motion and motor function in middle-aged men in the exercise group compared to those in the control group. In all, osteoarthritis in the exercise group improved significantly compared to the control group.

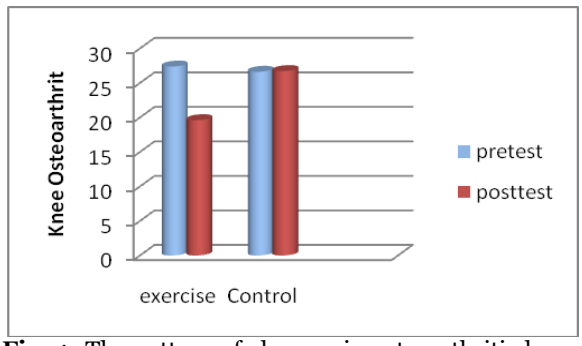

Fig. 1. The pattern of changes in osteoarthritis knee before and after 8 weeks Of exercise in water training and control groups.

Results of extensive research that has been carried out recently indicate that, compared to drug treatments, weight loss and exercise therapy are more effective, and have more conspicuous results, on pain reduction and on patients' quality of life (Bosomworth., 2009). In a study reviewing hydrotherapy and arthritis, the overall results showed that hydrotherapy clearly reduced pain indices and improved joint function and patients' quality of life (Candeloro *et al*., 2007).

In this research, one of the training exercise programs introduced in scientific publications was tried on a group of patients. It would probably be possible to compare various training exercise methods if different groups of patients were studied using different exercise systems. The Australian Rheumatology Academy conducted a study to compare the two aerobic training methods of walking and strength training and stretching exercises in water between the exercise group and the control group (who did not exercise). It was found that both exercise methods improved the disease in the patients and the pain relief coefficients were 10.390% for the aerobic exercises and 52% for stretching and strength training exercises in water (which were significantly different from those in the control groups), but there were no significant differences between these two exercise methods (Nagy *et al*., 2004). On the other hand, other research has shown that what improves the patients' function is the continuation of the exercises and that, if the exercises do not continue, the effects of improvement in the patients will disappear too (Sung, 2003).

Since one of the main problems people with arthritis and osteoarthritis face is muscle weakness, especially weakness of hamstring and quadriceps femoris muscles, knee flexion and knee extension will be difficult for them (Resende *et al*., 2008). Moreover, research conducted on humans and on animal models in the past 50 years has reported increases in factors such as activators of matrix metalloproteinases, cytokine receptor concentrations, synthesis of IL-1 α and IL-1 γ, and activation of the nitric oxide synthase and prostaglandins in joints affected by osteoarthritis. In osteoarthritis, pressure is exerted on elements inside and outside joints due to edema and inflammation in the synovial ligament and because of the increase in the volume of intercellular fluid. This pressure damages the soft joint tissues causing the release of inflammatory intermediates such as bradykinin, histamine, prostaglandins, lactic acid, and calcitonin gene-related peptides into the joints. The above-mentioned factors activate the peripheral nervous system receptors, lower the threshold of stimulation, and cause pain. What this research confirmed and defended was that water exercises reduced probable joint inflammation, decreased intracapsular pressure, lowered joint injuries, increased muscular power, especially that in the lower organs of the body and flexibity, and improved the disease trend (Zhang *et al*., 2010).

Conclusion

In general, findings in this research suggest that an 8-week water exercise program in middle-aged men was

accompanied by an improvement in knee osteoarthritis. Therefore, considering the results of this research and the observed effects of the exercise program on osteoarthritis, these exercises are recommended for all patients with osteoarthritis.

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