CE

Aquatic Exercise Program for Individuals With Osteoarthritis: Pain, Stiffness, Physical Function, Self-Efficacy

Tülay Kars Fertelli[1], PhD, RN, Mukadder Mollaoglu[1], PhD & Ozlem Sahin[2], PhD

Abstract

Purpose: This research was conducted to determine the effects of an aquatic exercise program on pain, stiffness, physical function, and self-efficacy in individuals with osteoarthritis.

Design: A randomized controlled trial.

Methods: Participants in the experimental group participated in the aquatic exercise program three times a week for 8 weeks; participants in the control group did not.

Findings: The mean scores of the experimental group on the pain, stiffness, and difficulty in carrying out physical functions subscales of the Western Ontario and McMaster Universities Osteoarthritis Index decreased significantly, whereas those of the control group decreased very little. The mean scores of the experimental group on the Arthritis Self-Efficacy Scale and the isokinetic muscle strength measurements increased, but those of the control group did not change in the final measurements. The difference between the groups was statistically significant.

Conclusions: Through the study, it was determined that the aquatic exercise program decreased pain, stiffness, and difficulty in carrying out physical functions and increased self-efficacy and muscle strength of individuals with osteoarthritis.

Clinical Relevance: The aquatic exercise program can be used by nurses as a reference in the management of osteoarthritic patients' health status.

Keywords: Aquatic exercise; nursing; osteoarthritis; pain; self-efficacy.

Introduction

Osteoarthritis (OA) is a progressive and degenerative joint disease that occurs during the synthesis or degradation of joint cartilage and subchondral bone. It is characterized by the destruction of joint cartilage, new bone formations on the surfaces of joints, arthralgia, and limitation of movement ability. Mostly knees and hips are affected. Knee and hip OA is widespread, seen in up to 6% of the population. Those with OA experience pain, stiffness, and limitation of movement in their affected joints (Bartels et al., 2016; Mattos, Leite, Pitta, & Bento, 2016). Pain and stiffness are the most important causes of difficulties individuals have when they are fulfilling physical activities of daily living. Therefore, individuals with OA limit their physical activity levels so as not to suffer more pain. Physical inactivity increases arthralgia, stiffness, muscle weakness, and weight gain, which leads to aggravation of the symptoms and progression of the degenerative process, thus creating a vicious cycle. These problems cause decreases in patients' self-confidence, life quality, and self-efficacy (Kim, Chung, Park, & Kang, 2012; Lu et al., 2015; Maly, Costigan, & Olney, 2006, 2007).

Self-efficacy is an important factor for the successful management of OA. It is defined as an individual's self-competence and self-confidence to maintain an attitude to perform exercises in any situation (Kim et al., 2012). In patients with arthritis, self-efficacy means individuals' belief in their ability to manage pain and problems caused by arthritis. Self-efficacy, which affects one's performing movements, is a strong indicator of exercising habit,

Correspondence: *Tülay Kars Fertelli, PhD, RN, Department of Nursing, Faculty of Health Sciences, Cumhuriyet University, Sivas, Turkey. E-mail: tkars@cumhuriyet.edu.tr, afertelli@gmail.com*

Ethical approval: For the study, ethical board endorsement was taken from the Ethical Board of the Faculty of Medicine (201105-12).

1 Department of Nursing, Faculty of Health Sciences, Cumhuriyet University, Sivas, Turkey

2 Physical Medicine and Rehabilitation Department, Faculty of Medicine, Cumhuriyet University, Sivas, Turkey

Cite this article as:
Fertelli, T. K., Mollaoglu, M., & Sahin, O. (2019). Aquatic exercise program for individuals with osteoarthritis: Pain, stiffness, physical function, self-efficacy. *Rehabilitation Nursing, 44*(5), 290–299. doi: 10.1097/rnj.0000000000000142

necessary for individuals with OA to improve their health (Maly et al., 2006). Exercise is essential to decrease pain and improve joint functions in the management of OA (Kim et al., 2012), as well as to increase self-efficacy (Petursdottir, Arnadottir, & Halldorsdottir, 2010). Some studies indicate that exercise has a positive effect on individuals' own performance and increases self-efficacy (Focht, Rejeski, Ambrosius, Katula, & Messier, 2005; Schlenk, Lias, Sereika, Dunbar-Jacob, & Kwoh, 2011). Therefore, modern guidebooks recommend exercise for the management of OA because of its many benefits (Kim et al., 2012; Mattos et al., 2016; Rasi et al., 2017).

Although exercise is recommended in the management of OA, 40%–56.5% of individuals with OA are inactive. Because of their pain, individuals with OA, in general, are determined to be reluctant to do or to resist doing all kinds of exercises that can be performed in all settings (Bartels et al., 2016; Gay, Chabaud, Guilley, & Coudeyre, 2016; Kim et al., 2012; Petursdottir et al., 2010). Therefore, studies have focused on the effect of different types of exercise on OA management (Kim et al., 2012; Lu et al., 2015) to encourage individuals with OA to do exercises willingly and to determine exercises they can do more comfortably. These studies have revealed that aquatic exercises provided a more comfortable and suitable environment for individuals with OA who were reluctant to exercise (Hinman, Heywood, & Day, 2007; Kim et al., 2012; Dunlop et al., 2011). Aquatic exercises are performed in water (Bartels et al., 2016; Kim et al., 2012). The basic principle of aquatic exercise is that water resistance and the buoyancy of water enable exercisers to relax (Kim et al., 2012; Lu et al., 2015). The buoyancy of water decreases the pressure and burden caused by the body on the joints. Thus, water facilitates the exercising of joints affected by OA, enables the person to perform movements more easily, and increases the effectiveness of the movements (Hinman et al., 2007; Kim et al., 2012; Lu et al., 2015; Mattos et al., 2016).

Some studies determined that aquatic exercise increased pain (Bartels et al., 2016; Hall, Swinkels, Briddon, & McCabe, 2008; Kim et al., 2012), physical function (Hinman et al., 2007; Kim et al., 2012), and self-efficacy (Kim et al., 2012). In the literature, there are several studies that examined the effect of exercise in the management of OA (Bartels et al., 2016; Foley, Halbert, Hewitt, & Crotty, 2003; Hinman et al., 2007). However, these studies are not strong and do not provide adequate evidence, and the number of randomized controlled studies is still very limited. Thus, there is a need for further studies (Bartels et al., 2016; Hall et al., 2008; Lu et al., 2015). Moreover, the effects and biomechanical requirements of each aquatic therapy can lead to different physiological and functional reactions (Denning, Bressel, & Dolny, 2010). In particular, water temperature and density play a great role in the emergence of these differences; therefore, it is suggested that studies with a strong methodological design should be conducted in waters at different temperatures and depths (Denning et al., 2010; Hall et al., 2008). However, so far, the effect of regional waters related to the issue has never been investigated. In addition, although not much, there is some evidence of the benefits of exercise performed by people with knee OA; however, there is very little evidence on the benefits of exercise performed by people with hip OA (Rasi et al., 2017). Therefore, the present study was conducted experimentally to determine the effects of an aquatic exercise program on the pain, stiffness, physical function, and self-efficacy of people with knee or hip OA.

The results obtained in this study are expected to contribute to the determination of the effects of a different intervention aiming to eliminate pain, stiffness, and difficulty in carrying out physical functions, the most common symptoms of OA, as well as to increase self-efficacy. The results are also expected to raise nurses' awareness of this method and to encourage nurses to utilize aquatic exercise when providing nursing care.

Methods

Design and Sample

The study was carried out in the thermal and spa facility run by the municipality. Permission was obtained from the Sivas Municipality to perform the study in this facility.

The study sample comprised individuals with knee or hip OA who presented to the Physical Treatment and Rehabilitation Polyclinics and underwent an outpatient pharmacological treatment. The sample size for the study was analyzed using Stats Direct (Ver. 2, 0, 0, Stats Direct Co., UK) software, and the following values were calculated: $\alpha = 0.05$, $\beta = 0.20$, and $1 - \beta = 0.80$. As a result, 120 individuals were included in the study sample ($p = .800$). People with OA who were in the 25 years and above age group, who were able to communicate and walk, whose pain level score was ≥5 according to the Western Ontario and McMaster Universities Arthritis Index (WOMAC), who had a medical report indicating their eligibility for aquatic exercise, who lived within the municipal boundaries of Sivas, and who volunteered to participate in study and individuals receiving pharmacological treatment were included in the study. On the other hand, individuals who had previously undergone hip or knee joint surgery; who had rheumatoid arthritis, hypertension, or myocardial infarction; and who had undergone intra-articular corticosteroid therapy in the last month were excluded from the sample.

Data Collection Tools

The study data were collected using the American College of Rheumatology (ACR) criteria, a sociodemographic questionnaire, WOMAC, and the Arthritis Self-Efficacy Scale (ASS).

ACR Criteria

This is a set of criteria developed by ACR to diagnose knee and hip OA. These criteria were developed to standardize the selection of study samples (Brandt, Doherty, & Lohmander, & 2003).

Sociodemographic Questionnaire

This questionnaire was developed by the researcher based on the literature. It is composed of 10 items questioning the participants' sociodemographic characteristics such as age, gender, and level of education.

Western Ontario and McMaster Universities Arthritis Index

The Turkish version of the index was validated by Tüzün, Eker, Aytar, Daşkapan, and Bayramoğlu (2005). The Cronbach's alpha values of the subscales are over .70. The index is composed of three subscales and 24 questions about pain, stiffness, and difficulty in carrying out physical functions. The highest possible scores that can be obtained are 20 for pain, 8 for stiffness, and 68 for difficulties experienced when engaging in activities of daily living (Bellamy, 2005; Tüzün et al., 2005).

Arthritis Self-Efficacy Scale

The ASS was developed by Lorig, Chastain, Ung, Shoor, and Holman (1989). It is composed of 20 items. The validity and reliability study of the scale was carried out by Ünsal and Kaşıkçı (2008). It assesses self-efficacy in four subscales: pain, foot–leg functions, hand–arm functions, and other symptoms. Self-efficacy in pain determines the perceived ability to decrease pain and conditions that keep pain at a low level. Self-efficacy in foot–leg and hand–arm functions expresses the extent to which these joints affected by arthritis can fulfill their functions. The lowest and highest possible scores to be obtained from the scale are 20 and 200, respectively. The Cronbach's alpha value was .96 (Ünsal & Kaşıkçı, 2008).

Assessment of Isokinetic Muscle Strength

Muscle strength assessment was conducted using a computer-controlled, isokinetic dynamometer (Biodex Corp., Shirley, NY). The system was calibrated before each test. The effects of gravity on torque were calculated by the software on the computer at 45° (0° = straight leg). For the test protocol, concentric exercise type was chosen both for the quadriceps and for the hamstring muscle groups. During the concentric test, the participants were asked to repeat exercises 5 times at 60° per second, 15 times at 180° per second, and 15 times at 240° per second angular speed. The individuals were told about the test protocol and were asked to bend and straighten their knees against the strength arm of the device with maximum effort during the whole movement (0–90°; Gür, Cakin, Akova, Okay, & Küçükoğlu, 2002).

Procedure

After the individuals were informed about the study, written and verbal consent was obtained from those who agreed to take part in the study. The patients who met the inclusion criteria were assigned to the experimental and control groups using simple random allocation. In order to achieve homogeneity between the groups, when the participants were assigned to the experimental and control groups, their total scores for the WOMAC were taken into account in such a way that the participants' scores in each group would be close to each other. The first individual who presented to the polyclinic was included in the experimental group. Of the remaining participants, those whose WOMAC score was similar to that of the first individual were assigned to the experimental group, and the other participants were assigned to the control group. The individuals in the experimental and control groups were administered the WOMAC and ASS the first time they presented to the polyclinic. Their isokinetic muscle strength measurements were also performed.

When the number of the participants in the experimental group was 60, they were called and asked to meet each other. At the meeting, the participants were informed about OA, the importance of the exercise, what the aquatic exercise is, and what its benefits are. Then, the aquatic exercise program to be conducted was introduced. The participants' questions with regard to the issue were answered.

In the literature, it is stated that if the aquatic exercise is to be beneficial, it should be done three to five times a week for at least 6 weeks, and each session should last 30–60 minutes (Kim et al., 2012). Therefore, the individuals in the experimental group did aquatic exercises 3 days a week, on Mondays, Wednesdays, and Fridays, between 5 pm and 8 pm, for 8 weeks (24 sessions). Each time, they exercised for 40 minutes. To this end, all the participants who met in the city center were picked up and taken to the pool in the thermal and spa facility. They were taken back to the city center after the exercise session was over.

On the fourth and eighth week of the implementation, the participants were administered the WOMAC and ASS again. At the end of the aquatic exercise program, a final interview was conducted to determine the participants' feelings, opinions, criticisms, and suggestions regarding the program, and the program was terminated. All the participants attended all sessions of the program.

The participants in the control group received no intervention other than pharmacological treatment recommended by the physician. Then, they were informed about at-home exercises and given a brochure on the issue, which is a part of the routine procedure in the physical therapy and rehabilitation polyclinic. They were asked to do these exercises regularly. During the fourth and eighth week of the program, the participants in the control group were called in for a health check and were administered the WOMAC and ASS. At the end of the eighth week, isokinetic muscle strength measurements were assessed for the second time, which was the last evaluation.

Aquatic Exercise Program

The aquatic exercise program was developed by Kim et al. (2012) for individuals with OA based on the Korean aquatic exercise program guidebook. The content of the exercise program was evaluated by professionals with five questions on a 4-point Likert-type scale. The questions concerned the appropriateness of the type, duration, frequency, and intensity of warm up, main exercise and cooling down exercises. Calculating the percentage and frequency of each item, the mean of all questions was 3.56 points (minimum of 3.48 and maximum of 3.65). The validity of the content of the exercise program was 0.87.

To avoid monotony and prevent boredom, fast music was played while the aquatic exercise was performed. To provide support for the participants to do certain movements, swim foam boards and balls were used. Exercises were done under the supervision of the researcher and a physiotherapist. For the participants to perform exercise movements successfully, they were shown how to do the movements at the poolside. The aim of doing so was to make participants more compliant, interested, and willing.

Before any aquatic exercise is started, the temperature and depth of water in the pool should be taken into consideration (Kim et al., 2012). In the literature, it is stated that water temperature should be 33 °C (Kim et al., 2012; Kindle, 2006) or higher and that studies should be carried out to find out the effects of different temperatures (Denning et al., 2010, Güvenir, 2007). The depth of the pool should be between 1 and 1.38 m, and the optimal depth is 1.20 m (Kindle, 2006). In the present study, the depth and length of the pool in which the aquatic exercises were done were 1.3 and 4.5 m, respectively. Water temperature ranged between 38 °C and 40 °C. In the exercise program, there should be warming-up, stretching, and cooling-down phases (Kim et al., 2012). The 40-minute-long aquatic exercise program involved 10 minutes of warming-up exercises, 20 minutes of basic exercises, and 10 minutes of cooling-down exercises. During the study, not to put the body under much strain, the intensity and repetition of the exercises were increased gradually (e.g., 8–15 repetitions, one to three sets). During the exercise, swim foam boards and balls were used to help the participants move their joints more easily. At the end of each session, whether they had any difficulty in doing the exercises was discussed with the participants. The participants did not mention any problems. They stated that they benefitted from the exercise program and were satisfied with the program.

In the study, the patients in the experimental group were assigned to do aquatic exercises, whereas the patients in the control group were informed about how to do exercises that should be done by patients with OA and told that they should do the exercises at home. Before the scales were administered, individuals in the experimental and control groups were told how to fill in the scales reflecting the levels of their pain, stiffness, body function, etc. In order to make the research findings more objective, the measurement of the isokinetic muscle strength of individuals in particular was carried out using a computer.

Ethical Considerations

To conduct the study, the approval of the ethics committee of the Faculty of Medicine of the university was obtained. The participants were informed of the study, and their written and verbal consent was obtained. They were also told that they could withdraw from the study at any time.

Data Analysis

The study data were analyzed using the SPSS (Version 10.0, SPSS, Inc., Chicago, IL) package program. In the data analysis, frequency, a chi-square test, an independent samples *t* test, and a repeated-measures analysis of variance test were used.

Results

The mean age of the individuals in the experimental group was 54.80 ± 7.74. Of them, 48.3% were in the 52–62 years age group, 91.7% were women, 76.7% were housewives, 38.3% were primary school graduates, 75% had knee OA, 33.4% had Grade 2 OA, and 68.3% did not exercise. The mean age of the individuals in the control group was 56.48 ± 7.67. Of them, 45% were in the 52–62 years age group, 91.7% were women, 76.7% were housewives, 38.3% were elementary school graduates, 75% had knee OA, 33.3% had Grade 2 OA, and 65% did not exercise. No significant difference was found between the groups in terms of these variables ($p > .05$; Table 1).

Although no significant difference was determined between the experimental group and the control group in terms of pain, stiffness, physical function, and WOMAC total scores in the first measurement ($p > .05$), there were differences in the intermediate and final measurements ($p < .05$). In the final measurement, the mean scores of the participants in the experimental group on the pain, stiffness, and difficulty in carrying out physical functions subscales (14.43 ± 6.40, 5.52 ± 5.87, and 46.90 ± 17.22, respectively) were lower than the scores (7.00 ± 4.44, 2.00 ± 2.13, and 26.10 ± 15.59, respectively) of the participants in the control group (Table 2).

A significant difference was determined between the individuals in the experimental and control groups in terms of total ASS and its pain and other functions subscales in the first measurement ($p = .019$, $p = .020$, $p = .012$). The difference in terms of foot, leg, hand, and arm functions was not significant ($p = .731$, $p = .278$). In the first measurement, all scores of the control group were higher. In the intermediate and final measurements, pain, foot–leg, hand–arm, and other functions and overall scores of the experimental group were higher than those of the control group, and the difference was significant in favor of the experimental group ($p = .001$; Table 2).

In the present study, there was no significant difference ($p > .05$) between the measurements of the experimental and control groups in the first measurement, except for the right knee flexion test at 240° per second and 60° per second. In the last measurement of the groups,

Table 1 Characteristics of individuals

Variables	Experimental Group (n = 60) n (%)	Control Group (n = 60) n (%)	χ^{2a}	p
Mean age	($X \pm SD$ = 54.80 ± 7.74)	($X \pm SD$ = 56.48 ± 7.67)		
Age				
41–51 years	21 (5.0)	17 (28.3)		
52–62 years	29 (48.3)	27 (45.0)	1.87	.391
>62 years	10 (16.7)	16 (26.7)		
Gender				
Female	55 (91.7)	55 (91.7)	0.00	.695
Male	5 (8.3)	5 (8.3)		
Job				
Housewife	46 (76.7)	46 (76.7)		
Officer	5 (8.3)	6 (10.0)	0.15	.928
Retired	9 (15)	8 (13.3)		
Educational status				
Illiterate	5 (8.3)	8 (13.3)		
Reader–writer	12 (20.0)	13 (21.7)		
Elementary school	23 (38.3)	23 (38.3)	1.53	.821
Middle School	8 (13.4)	8 (13.3)		
High school and higher	12 (20)	8 (13.4)		
Affected joints				
Knee	45 (75)	45 (75)	0.00	1.00
Hip	15 (25)	15 (25)		
Classification of diseases				
Grade 1	17 (28.4)	15 (25.0)	0.22	.974
Grade 2	20 (33.4)	20 (33.3)		
Grade 3	16 (26.8)	17 (28.3)		
Grade 4	7 (11.4)	8 (13.4)		
Exercising daily life situations				
Did do exercise	19 (31.7)	21 (35)	0.15	.699
Did not do exercise	41 (68.3)	39 (65)		

[a]Chi-square test for independence.

Table 2 Comparison of the groups in the first, interim, and final measurement in terms of WOMAC and ASS scores

Scales	Experimental Group *M* ± *SD*	Control Group *M* ± *SD*	t^a	*p*
WOMAC subcomponents, and the grand total				
First measurement				
Pain	14.43 ± 3.82	15.35 ± 4.41	1.21	.227
Stiffness	5.78 ± 2.49	5.73 ± 2.62	0.10	.915
Physical function	50.32 ± 16.04	50.97 ± 11.70	0.25	.800
Total	70.53 ± 20.50	72.05 ± 15.91	0.45	.652
Intermediate measurement				
Pain	11.38 ± 3.23	14.46 ± 5.69	3.64	.001**
Stiffness	4.41 ± 1.81	8.38 ± 11.25	2.69	.008*
Physical function	40.10 ± 12.83	46.23 ± 15.29	2.37	.019*
Total	55.90 ± 15.90	69.08 ± 20.98	3.87	.001**
Final measurement				
Pain	7.00 ± 4.44	14.43 ± 6.40	7.38	.001**
Stiffness	2.00 ± 2.13	5.52 ± 5.87	4.35	.001**
Physical function	26.10 ± 15.59	46.90 ± 17.22	6.93	.001**
Total	35.10 ± 20.63	66.85 ± 25.79	7.44	.001**
ASS subcomponents, and the grand total				
First measurement				
Pain	19.15 ± 8.15	22.57 ± 7.61	2.37	.019*
Foot–leg function	30.37 ± 14.56	33.03 ± 12.11	0.34	.731
Hand–arm function	15.72 ± 9.78	16.33 ± 9.82	1.09	.278
Other function	22.70 ± 10.62	27.50 ± 9.97	2.55	.020*
Total	87.93 ± 31.51	99.43 ± 29.77	2.05	.012*
Intermediate measurement				
Pain	27.33 ± 7.92	23.25 ± 8.81	2.66	.009*
Foot–leg function	37,63 ± 10.33	32.75 ± 13.35	2.15	.033*
Hand–arm function	25.70 ± 9.27	21.31 ± 12.74	2.24	.027*
Other function	35.31 ± 10.19	26.53 ± 12.33	4.25	.001**
Total	125.98 ± 27.82	103.85 ± 35.08	3.82	.000*
Final measurement				
Pain	32.05 ± 9.59	22.35 ± 10.50	5.28	.001**
Foot–leg function	29.97 ± 12.15	20.15 ± 14.58	4.00	.001**
Hand–arm function	41.68 ± 10.60	33.03 ± 14.62	3.70	.001**
Other function	41.92 ± 11.79	27.93 ± 14.98	5.68	.001**
Total	145.61 ± 35.46	103.46 ± 46.92	5.55	.001**

Note. ASS = Arthritis Self efficacy Scale; WOMAC = Western Ontario and McMaster Universities Arthritis Index.
*$p < .05$. **$p < .001$.
[a]Independent *t* test.

there was a significant difference ($p = .022$, $p = .011$, $p = .214$, $p = .003$) between the experimental and control groups in the right knee extension at 240° per second, in the left knee flexion at 240° per second, in the right knee extension at 180° per second, and in the right knee extension at 60° per second (Table 3).

Discussion

In the study, the comparison of the characteristics of the individuals in the control and experimental groups revealed that the groups were similar. In the first measurement before starting the aquatic exercise program, the mean scores obtained from the WOMAC and its subscales by the participants in the experimental and control group were close to each other, and there was no significant difference between them. These results are important in that individuals in both groups had similar scores and characteristics. It was determined that the pain, stiffness, and physical function scores of the individuals in both groups were high. This result is similar to the results of other studies, which indicates that individuals with OA have problems because of pain, stiffness, and difficulty in carrying out physical functions (Hinman et al., 2007; Maly et al., 2007).

There were differences between the groups in terms of intermediate and final measurements. The aquatic exercise program applied in the experimental group decreased their WOMAC pain, stiffness, physical function, and total scores, and the aquatic exercise program was effective starting with the first measurement. In the literature, other studies on the effects of aquatic exercise on individuals with OA obtained similar results

Table 3 Isokinetic muscle power peak torque scores of individuals with knee osteoarthritis at 240°, 180°, and 60° per second in the first and last measurement

		First Measurement				Final Measurement			
		Experimental Group (n = 41) $M \pm SD$	Control Group (n = 42) $M \pm SD$	t^a	p	Experimental Group (n = 41) $M \pm SD$	Control Group (n = 42) $M \pm SD$	t^a	p
E 240°	RK	37.11 ± 17.53	38.87 ± 11.60	0.54	.591	47.87 ± 14.89	40.30 ± 14.55	2.34	.022*
	LK	40.38 ± 18.7	42.00 ± 13.55	0.45	.651	47.88 ± 16.41	41.40 ± 16.24	1.80	.074
F 240°	RK	28.63 ± 11.50	34.92 ± 8.44	2.75	.007*	39.21 ± 8.92	36.35 ± 8.90	1.46	.147
	LK	31.97 ± 11.68	34.44 ± 6.81	1.17	.243	42.16 ± 7.91	36.37 ± 9.07	3.09	.003*
E 180°	RK	49.47 ± 22.18	45.58 ± 9.79	1.03	.302	56.41 ± 17.73	47.73 ± 11.94	2.62	.011*
	LK	48.01 ± 18.18	49.07 ± 11.89	0.31	.754	53.84 ± 15.86	49.69 ± 16.26	1.17	.243
F 180°	RK	36.16 ± 11.45	38.85 ± 7.91	1.24	.216	42.81 ± 9.00	42.23 ± 9.96	0.92	.360
	LK	37.21 ± 11.05	40.39 ± 7.61	1.53	.130	45.28 ± 7.57	41.13 ± 9.86	1.56	.121
E 60°	RK	64.74 ± 24.96	63.40 ± 14.97	0.29	.768	71.48 ± 25.36	61.92 ± 16.12	2.05	.214*
	LK	65.09 ± 24.75	64.75 ± 16.42	0.07	.942	70.80 ± 24.71	64.84 ± 18.23	1.25	.043
F 60°	RK	43.54 ± 14.74	50.20 ± 10.36	2.38	.020*	50.06 ± 13.19	50.75 ± 10.49	0.26	.793
	LK	45.52 ± 13.26	49.25 ± 11.22	1.38	.170	52.75 ± 13.01	58.94 ± 62.48	0.62	.536

Note. E = extension; F = flexion; LK = left knee; RK = right knee.
*$p < .05$.
[a]Independent t test.

related to WOMAC pain, stiffness, and physical function subscales (Ansari, Elmieh, & Hojjati, 2014; Bartels et al., 2016; Denning et al., 2010; Mattos et al., 2016).

Contrary to the result of this present study, some studies in the literature indicate that aquatic exercise does not have a significant effect (Foley et al., 2003; Lu et al., 2015). These differences in results can stem from the differences in the characteristics of the samples. For instance, in the present study, the sample included volunteer participants with a mean age of 55 years in the second stage of the disease. On the contrary, in a study by Foley et al. (2003), the participants' mean age was 70.9, and 44% of them were in the final stage of the disease and were waiting to be operated on. Similar to this study, another study on patients with knee or hip OA determined that there was no significant difference between the group that did land-based exercises and the group that did aquatic exercises. There was a decrease in WOMAC pain scores in the two groups; however, the aquatic exercise had a more positive effect (Gill, McBurney, & Schulz, 2009). It is worth noting that the sample of that study was composed of patients with end-stage knee or hip OA who were waiting to be operated on.

Some studies have shown that aquatic exercise did not have an important effect. In their study, Hale, Waters, and Herbison (2012) compared a 12-week aquatic exercise program implemented twice a week to a computer-based education program, and they determined that there was no significant difference between the two groups in terms of their WOMAC pain, stiffness, and difficulty in carrying out physical functions scores. In another study that involved a twice-a-week exercise program for 8 weeks with three groups (aquatic, land, control), there was a decrease in visual analog scale pain scores of the group that did the land exercises, and there was not a difference between the aquatic exercise group and the control group (Lund et al., 2008). Stover et al. (2015), who examined the effect of aquatic exercise done once a week for a period of 8 weeks, found similar results. The comparison of the frequencies of the aquatic exercise in the aforementioned studies demonstrated that aquatic exercises were done twice a week in some studies and once a week in other studies. In this present study, aquatic exercise was done three times a week. The difference in the results can be attributed to the frequency of exercises.

Another factor investigated in the present study was self-efficacy. Self-efficacy is the most important determining factor for the habit of exercising. Just as self-efficacy contributes to the habit of doing exercises, so does doing exercise contribute to self-efficacy (Maly et al., 2006; Petursdottir et al., 2010). Gyurcsik, Estabrooks, and Frahm-Templar (2003) stated that an 8-week aquatic exercise program increased self-efficacy in 216 patients with arthritis. Kang, Ferrans, Kim, Kim, and Lee (2007) stated that 6 weeks of aquatic exercise done with 72 Korean women three times a week increased their self-efficacy. Kim et al. (2012) found that the self-efficacy of individuals in the aquatic exercise group increased whereas self-efficacy of individuals in the control group decreased. In this study, it was determined that the aquatic exercise program was effective in increasing the participants' self-efficacy. This result is important in that it shows that nurses who come across individuals with OA who are reluctant to do exercise can make use of aquatic exercises to increase self-efficacy and exercise compliance, thus breaking the vicious cycle of pain, stiffness, and inactivity.

In the present study, the results were assessed using an isokinetic dynamometer controlled by a computer (Şahin, 2010) because it is regarded as the most objective and reliable method. The analysis of the results indicated that there was no significant difference between the peak torque scores of the two groups in the first measurements (except for right knee flexion at 240° per second and 60° per second) and that the muscle strength scores of both groups were similar and low. This result is similar to the results of the study by Salli, Şahin, Başkent, and Uğurlu (2010). In the present study, the increase in muscle strength was probably due to the fact that aquatic exercises reduced pain, stiffness, and difficulty in physical functioning. Aquatic exercise may have enabled the individuals to move better by reducing such discomforts. As a matter of fact, in the literature, it is stated that pain and stiffness can affect the development of muscle weakness (Bartels et al., 2016). When all these results are taken into account, aquatic exercises can be regarded as an important strategy to increase muscle strength and OA rehabilitation.

Nurses who have an important role in solving problems that arise during the rehabilitation of patients with OA are supposed to manage the disease well, to help patients develop self-confidence and self-efficacy, and to recommend that patients do aquatic exercises to improve their quality of life. They should include aquatic exercises in the provision of health care. They should help the patient to select the exercise program appropriate for the patient while providing health care, and they should plan the exercise program in line with the individual's needs and preferences after talking to the patient. Before recommending that the patient start exercising, they should evaluate factors such as pain, stiffness, physical activity level, self-efficacy, fatigue and belief, as well as cost, time, and accessibility of the exercise. They should inform the patient about the aquatic exercise and provide support to him or her when he or she does the exercises. They should also assess the effectiveness and applicability of the exercise and conduct research on the issue (Egan & Mentes, 2010; Kim et al., 2012).

The findings indicate that aquatic exercises improve well-being of patients with OA. However, whether individuals with OA do these exercises or not depends on the geographical area they are in. (The geographical area in which individuals with OA live affects their decision to do exercises.) In the United States, in regions where there are facilities such as the Young Men's Christian Association, or in North America, Europe, and Korea, where aquatic exercises are more common, nurses can motive individuals to perform aquatic exercises. Health personnel in rehabilitation centers or nursing homes with such facilities can be informed of this issue and may initiate aquatic exercise programs. However, lack of spas or pools in some areas can prevent people from performing aquatic exercises.

The study included only individuals receiving pharmacological treatment. However, it was not possible for individuals to receive the same pharmacological treatment. This might be a factor affecting the study results. It is recommended that future relevant studies should be designed, taking into account this factor.

Key Practice Points

- Aquatic exercise programs should be included in the comprehensive osteoarthritis rehabilitation program.
- It is important for rehabilitation nurses to promote exercises.
- It was concluded that the aquatic exercise program decreased pain, stiffness, and difficulty in physical functions and increased self-efficacy in individuals with osteoarthritis.
- It is recommended that nurses assess pain, stiffness, difficulty in physical functioning, and low self-efficacy levels, which are important problems in the management of OA; utilize aquatic exercises to solve these problems; and suggest that their patients do aquatic exercises.

Conclusion

It was concluded that the aquatic exercise program decreased pain, stiffness, and difficulty in physical functions and increased self-efficacy in individuals with knee or hip OA. In line with these results, it is recommended that nurses assess pain, stiffness, difficulty in physical functioning, and low self-efficacy levels, which are important problems in the management of OA; utilize aquatic exercises to solve these problems; and suggest that their patients do aquatic exercises. It is also recommended that individuals, patients, communities, and health personnel should be informed about aquatic exercises. In the future, long-term studies should be conducted with larger samples using different exercise programs.

Acknowledgments
The authors would like to thank all the study participants.

Conflicts of Interest
The authors declare no conflict of interest.

Funding
This study is financed by the Cumhuriyet University Scientific Research Projects Unit (SBF-018). The authors have no financial relationships relevant to this article to disclose.

References

Ansari, S., Elmieh, A., & Hojjati, Z. (2014). Effects of aquatic exercise training on pain, symptoms, motor performance, and quality of life of older males with knee osteoarthritis. *Annals of Applied Sport Science*, *2*, 29–38. http://aassjournal.com/article-1-101-en.html

Bartels, E. M., Juhl, C. B., Christensen, R., Hagen, K. B., Danneskiold-Samsøe, B., Dagfinrud, H., & Lund, H. (2016). Aquatic exercise for the treatment of knee and hip osteoarthritis. *Cochrane Database of Systematic Reviews*, *23*, 1–66. doi:10.1002/14651858.CD005523.pub3

Bellamy, N. (2005). The WOMAC knee and hip osteoarthritis indices: Development, validation, globalization and influence on the development of the AUSCAN hand osteoarthritis. *Clinical and Experimental Rheumatology*, *23*, S148–S153. http://www.clinexprheumatol.org/article.asp?a=2700

Brandt, K. D., Doherty, M., & Lohmander, L. S. (2003). *Osteoarthritis* (2th ed., pp. 381–90 ed.). New York, NY: Oxford Medical Press.

Denning, W. M., Bressel, E., & Dolny, D. G. (2010). Underwater treadmill exercise as a potential treatment for adults with osteoarthritis. *International Journal of Aquatic Research and Education*, *4*, 70–80. http://scholarworks.bgsu.edu/ijare/vol4/iss1/9

Dunlop, D. D., Song, J., Semanik, P. A., Chang, R. W., Sharma, L., Bathon, J. M., … Hootman, J. M. (2011). Objective physical activity measurement in the osteoarthritis initiative: Are guidelines being met? *Arthritis and Rheumatism*, *63*, 3372–82. doi:10.1002/art.30562

Egan, B. A., Mentes, J. C. (2010). Benefits of physical activity for knee osteoarthritis. *Journal of Gerontological Nursing*, *36*, 9–14. doi:10.3928/00989134-20100730-03

Focht, B. C., Rejeski, W. J., Ambrosius, W. T., Katula, J. A., & Messier, S. P. (2005). Exercise, self-efficacy, and mobility performance in overweight and obese older adults with knee osteoarthritis. *Arthritis and Rheumatism*, *53*, 659–665.

Foley, A., Halbert, J., Hewitt, T., & Crotty, M. (2003). Does hydrotherapy improve strength and physical function in patients with osteoarthritis? A randomized controlled trial comparing a gym based and a hydrotherapy based strengthening programme. *Annals of the Rheumatic Diseases*, *62*, 1162–1167. doi:10.1136/ard.2002.005272

Gay, C., Chabaud, A., Guilley, E., & Coudeyre, E. (2016). Educating patients about the benefits of physical activity and exercise for their hip and knee osteoarthritis. Systematic literature review. *Annals of Physical Rehabilitation Medicine*, *59*(3), 174–83.

Gill, S. D., McBurney, H., & Schulz, D. L. (2009). Land based versus pool-based exercise for people awaiting joint replacement surgery of the hip or knee: Results of a randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, *90*, 388–394. doi:10.1016/j.apmr.2008.09.561

Gür, H., Cakin, N., Akova, B., Okay, E., & Küçükoğlu, S. (2002). Concentric versus combined concentric-eccentric isokinetic training: Effects on functional capacity and symptoms in patients with osteoarthrosis of the knee. *Archives of Physical Medicine Rehabilitation*, *83*, 308–16. https://www.ncbi.nlm.nih.gov/pubmed/11887109

Güvenir, H. (2007). *Diz osteoartritli olgularda iki farklı havuz içi egzersiz eğitiminin fiziksel yetersizlik, ağrı, günlük yasam aktivitesi ve depresyon üzerine etkisi* (Master's thesis). Başkent University, Ankara, Turkey. http://dspace.baskent.edu.tr:8080/xmlui/handle/11727/1493 (In Turkish).

Gyurcsik, N. C., Estabrooks, P. A., & Frahm-Templar, M. J. (2003). Exercise-related goals and self-efficacy as correlates of aquatic exercise in individuals with arthritis. *Arthritis Rheumatism*, *49*, 306–313. doi:10.1002/art.11123

Hale, L. H., Waters, D., & Herbison, P. (2012). A randomized controlled trial to investigate the effects of water-based exercise to improve falls risk and physical function in older adults with lower-extremity osteoarthritis. *Archives of Physical Medicine and Rehabilitation*, *93*, 27–34. doi:10.1016/j.apmr.2011.08.004

Hall, J., Swinkels, A., Briddon, J., & McCabe, C. S. (2008). Dose aquatic exercise relieve pain in adults with neurologic or musculoskeletal disease? A systematic review and meta-analysis of randomized controlled trials. *Archives of Physical Medicine and Rehabilitation*, *89*, 873–883. doi:10.1016/j.apmr.2007. 09.054

Hinman, R. S., Heywood, S. E., & Day, A. R. (2007). Aquatic physical therapy for hip and knee osteoarthritis: Results of a single-blind randomized controlled trial. *Physical Therapy*, *87*, 32–43. http://dx.doi.org/10.1007/s00393-014-1559-9

Kang, H. S., Ferrans, C. E., Kim, M. J., Kim, J. I., & Lee, E. O. (2007). Aquatic exercise in older korean women with arthritis: Identifying barriers to and facilitators of long-term adherence. *Journal of Gerontological Nursing*, *33*, 48–56. https://www.ncbi.nlm.nih.gov/pubmed/17672168

Kim, I. S., Chung, S. H., Park, Y. J., & Kang, H. Y. (2012). The effectiveness of an aquarobic exercise program for patients with osteoarthritis. *Applied Nursing Research*, *25*, 181–89. doi:10.1016/j.apnr.2010.10.001

Kindle, J. M. (2006). *Aquatic fitness professional manual* (3th ed.), 83–96. Busan: Shinji Press.

Lorig, K., Chastain, R. L., Ung, E., Shoor, S., & Holman, H. R. (1989). Development and evaluation of a scale to measure perceived self-efficacy in people with arthritis. *Arthritis Rheumatism*, *32*, 37–44. doi:10.1002/anr.1780320107

Lu, M., Su, Y., Zhang, Y., Zhang, Z., Wang, W. O., Liu, F., … Zheng, N.. (2015). Effectiveness of aquatic exercise for treatment of knee osteoarthritis: Systematic review and meta-analysis. *Zeitschrift fur Rheumatologie*, *74*, 543–52. doi:10.1007/s00393-014-1559-9

Lund, H., Weile, U., Christensen, R., Rostock, B., Downey, A., Bartels, E., … Bliddal, H. (2008). A randomized controlled trial of aquatic and land-based exercise in patients with knee osteoarthritis. *Journal of Rehabilitation Medicine*, *40*, 137–144. doi:10.2340/16501977-0134

Maly, M. R., Costigan, P. A., & Olney, S. J. (2006). Determinants of self efficacy for physical tasks in people with knee osteoarthritis. *Arthritis and Rheumatism*, *55*, 94–101. doi:10.1002/art.21701

Maly, M. R., Costigan, P. A., & Olney, S. J. (2007). Self-efficacy mediates walking performance in older adults with knee osteoarthritis. *Journal of Gerontology*, *62*, 1442–1146. doi:10.1093/gerona/62.10.1142

Mattos, F., Leite, N., Pitta, A., & Bento, P. C. (2016). Effects of aquatic exercise on muscle strength and functional performance of individuals with osteoarthritis: A systematic review. *Revista Brasileira de Reumatologia*, *56*, 530–542. doi:10.1016/j.rbre. 2016.09.003

Petursdottir, U., Arnadottir, A. S., & Halldorsdottir, S. (2010). Facilitators and barriers to exercising among people with osteoarthritis: A phenomenological study. *Physical Therapy*, *90*, 1014–1025. doi:10.2522/ptj.20090217

Rasi, U. K., Patil, R., Karinkanta, S., Tokola, K., Kannus, P., & Sievänen, H. (2017). Exercise training in treatment and rehabilitation of hip osteoarthritis: A 12-week pilot trial. *Journal of Osteoporosis*, *2017*, 1–7. doi:10.1155/2017/3905492

Şahin, O. (2010). Isokinetic assessments in rehabilitation. *Cumhuriyet Medical Journal*, *32*, 386–96. http://dergi.cumhuriyet.edu.tr/cumucmj/article/view/1008000403 (In Turkish).

Salli, A., Şahin, N., Başkent, A., & Uğurlu, H. (2010). The effect of two exercise programs on various functional outcome measures in patients with osteoarthritis of the knee: A randomized controlled clinical trial. *Isokinetics and Exercise Science*, *18*, 201–209. doi:10.3233/IES-2010-0385

Schlenk, E. A., Lias, J. L., Sereika, S. M., Dunbar-Jacob, J., & Kwoh, C. K. (2011). Improving physical activity and function in overweight and obese older adults with osteoarthritis of the knee: A feasibility study. *Rehabilitation Nursing*, *36*, 32–42. doi:10.1002/j.2048-7940.2011.tb00063

Stover, A., Smith, C., Maloney, J., Mitchell, C., Michaels, N., Jones, T., & Raynes, E. (2015). Aquatic exercise for pain reduction in the active adult with osteoarthritis. *The Journal Aquatic Physical Therapy*, *23*, 1–19.

Tüzün, E. H., Eker, L., Aytar, A., Daşkapan, A., & Bayramoğlu, M. (2005). Acceptability, reliability validity and responsiveness of the Turkish version of WOMAC osteoarthritis index. *Osteoarthritis and Cartilage*, *13*, 28–33. doi:10.1016/j.joca.2004.10.010

Ünsal, A., Kaşıkçı, M. (2008). Validity and reliability of self-efficacy scale in arthritis. *Journal of Anatolia Nursing and Health Sciences*, *11*, 40–50. http://e-dergi.atauni.edu.tr/ataunihem/article/view/1025000629/1025000621 (In Turkish).

For 47 additional continuing education articles related to musculoskeletal topics, go to NursingCenter.com/CE.

Instructions:

- Read the article. The test for this CE activity can be taken online at www.NursingCenter.com/CE/RNJ. Tests can no longer be mailed or faxed.
- You will need to create a username and password and login to your personal CE Planner account before taking online tests. Your planner will keep track of all your Lippincott Professional Development online CE activities for you.
- There is only one correct answer for each question. A passing score for this test is 7 correct answers. If you pass, you can print your certificate of earned contact hours and access the answer key. If you fail, you have the option of taking the test again at no additional cost.
- For questions, contact Lippincott Professional Development: 1-800-787-8985.

Registration Deadline: September 3, 2021

Disclosure Statement:
The authors and planners have disclosed that they have no financial relationships related to this article.

Provider Accreditation:

Lippincott Professional Development will award 1.0 contact hour for this continuing nursing education activity.

Lippincott Professional Development is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.0 contact hour. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia, Georgia, and Florida, CE Broker #50-1223.

Payment:

- The registration fee for this test is $10.00 for members and $12.50 for nonmembers.
  1. ARN members can access the discount by logging into the secure "Members Only" area of http://www.rehabnurse.org.
  2. Select the Education tab on the navigation menu.
  3. Select Continuing Education.
  4. Select the Rehabilitation Nursing Journal article of your choice.
  5. You will appear at nursing.CEConnection.com.
  6. Log in using your Association of Rehabilitation Nursing username and password. The first time you log in, you will have to complete your user profile.
  7. Confirm the title of the CE activity you would like to purchase.
  8. Click start to view the article or select take test (if you have previously read the article.)
  9. After passing the posttest, select +Cart to add the CE activity to your cart.
  10. Select check out and pay for your CE activity. A copy of the receipt will be emailed.