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Original article

Land-based versus water-based walking programs in elderly women with knee osteoarthritis: preliminary results of a randomized clinical trial

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Abstract

Introduction: Knee osteoarthritis (kOA) is a chronic degenerative disorder. Aerobic exercise programs have been effective treatments to reduce symptoms in kOA. However, studies comparing land- and water-based interventions did not control for the intensity of exercise programs. Objectives: Investigate the effects of walking programs with a controlled progressive workload in water compared to land in terms of pain, functional and physical performance, and quality of life in elderly women with kOA. Materials and Methods: The walking training programs were divided into two groups: 1) land-based aerobic training (LB); and 2) water-based aerobic training (WB). Each training session was divided into three phases: 1 – Warm-up (5 minutes): stretching exercises; 2 - Training (30 to 55 minutes): walking at target heart rate; 3 – Cool-down (5 minutes). Sixteen elderly women with kOA underwent assessments of functional performance using the six-minute walk test (6MWT) and the stair test (ST), while physical performance, maximum oxygen consumption (VO2max) and anaerobic threshold (AT) were determined during a progressive test. kOA was assessed by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and quality of life was assessed using the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36). All parameters were reevaluated after 12 weeks of aerobic training that consisted of walking (duration: 30-55 min.; intensity: 72-82% of maximal heart rate). Results: No significant difference between the LB and WB groups was found. There was a reduction in self-reported pain (by WOMAC), increased performance in the 6MWT and ST, increased VO2max and VO2max corresponding to AT and improved quality of life (by SF-36) in both groups after training compared with before intervention. Conclusion: Land-based aerobic training was as effective as its water-based equivalent in clinical, physical and functional parameters in elderly women with knee OA.

Keywords: Osteoarthritis of knee; Elderly; Aerobic training.

Resumo

Programa de caminhada realizado na água versus solo em idosas com osteoartrite de joelho: resultados preliminares de ensaio clínico randomizado

Introdução: A osteoartrite de joelho (OA) é uma doença crônica degenerativa. Programas de exercícios aeróbicos têm sido eficazes para reduzir os sintomas da OA. Entretanto, os estudos que compararam intervenções no solo e na água não controlaram a intensidade dos programas de exercício. Objetivos: Investigar os efeitos do treinamento de caminhada na água comparado com solo na dor, desempenho funcional e físico e qualidade de vida em idosas com OA. Material e Métodos: Tanto o programa de treinamento terrestre (TT) quanto na água (TA) foram divididos em três fases: 1 - Aquecimento (5 minutos): exercícios de alongamento; 2 - Treino (30 a 55 minutos): caminhada na frequência cardíaca alvo; 3 - Resfriamento (5 minutos). Dezesseis idosas com AO de joelho foram submetidas à avaliação do desempenho funcional por meio do teste de caminhada de seis minutos (TC'6) e teste de escada (TE), consumo máximo de oxigênio (VO2máx) e limiar anaeróbio (LA). A AO de joelho foi avaliada pelo questionário WOMAC e a qualidade de vida foi avaliada usando o SF-36. Todos os parâmetros foram reavaliados após 12 semanas de treinamento aeróbico que consistiu em caminhada (duração: 30-55 minutos; intensidade: 72-82% da frequência cardíaca máxima) no solo (TT) ou na

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água (TA). Resultados: Não houve diferença significativa entre os grupos TT e TA antes da intervenção em todos os desfechos avaliados. Houve redução na dor auto referida (pelo WOMAC), aumento do desempenho no TC'6 e TE, aumento do VO2max e VO2max correspondente ao LA e melhor qualidade de vida (pelo SF-36) nos dois grupos após treinamento comparado com antes da intervenção. Conclusão: Treinamento de caminhada no solo foi tão efetivo quanto na água em parâmetros clínicos, físicos e funcionais em idosas com OA de joelho.

Descritores: Osteoartrite do joelho; Idoso; Exercício Aeróbico.

Resumen

Programa de caminata terrestre versus programa acuático en mujeres ancianas con osteoartritis de rodilla: resultados preliminares de un ensayo clínico aleatorizado

Introducción: Osteoartritis de la rodilla (OA) es un trastorno crónico degenerativo. Programas de ejercicio aeróbicos son eficaces para reducir los síntomas en OA. Sin embargo, los estudios existentes no controlaron la intensidad de los programas de ejercicios. Objetivos: Investigar los efectos del programa de caminata con una carga de trabajo progresiva controlada en el agua en comparación con la tierra en relación con el dolor, el rendimiento funcional y físico, y la calidad de vida en ancianas con OA. Material y Métodos: El programa de entrenamiento se dividió en: 1) entrenamiento terrestre (ET); 2) Entrenamiento acuático (EA), cada sesión de entrenamiento se dividió en tres fases: 1 - Calentamiento (5 minutos): ejercicios de estiramiento; 2 - Entrenamiento (30 a 55 minutos): caminar a la frecuencia cardíaca deseada; 3 - Enfriamiento (5 minutos).. Dieciséis ancianas con OA se sometieron a evaluaciones del rendimiento funcional mediante la prueba de caminata de seis minutos (C6M) y la prueba de escalera (ES), el consumo máximo de oxígeno (VO2max) y el umbral anaeróbico (UA). OA se evaluó mediante el índice WOMAC, y la calidad de vida se evaluó mediante la SF-36. Todos los parámetros fueron reevaluados después de 12 semanas de entrenamiento aeróbico (duración: 30-55 minutos; intensidad: 72-82% de la frecuencia cardíaca máxima). Resultados: No se encontraron diferencias significativas entre los grupos ET y EA. Hubo una reducción en el dolor autoinformado (por WOMAC), mayor rendimiento en C6M y ES, mayor VO2max y VO2max correspondiente a UA y mejor calidad de vida (por SF-36) en comparación con antes de la entrenamiento. Conclusión: Ambos programas de caminata se asociaron con resultados comparables en mujeres ancianas con OA.

Palabras clave: Osteoartritis de la Rodilla; Anciano; Ejercicio.

Introduction

Osteoarthritis (OA) is a chronic degenerative disorder that frequently affects the knee joint[1,2] resulting in pain, stiffness, swelling, weakness, and joint instability. Its prevalence increases with age, and OA is responsible for a higher incidence of disability than any other chronic disease in elderly populations.[2]

Patients with kOA frequently report pain and problems with daily living activities and exercise, and have greater difficulty in performing physical and functional activities compared to healthy individuals.[3] Furthermore, pain and other symptoms of OA may have a profound effect on quality of life, affecting both physical functions and psychological parameters.[4] As a result, these alterations may heighten individuals' subjective perception of pain and stiffness, as well as decrease physical function, hampering the performance of functional activities[5] such as walking, getting up from a chair, sitting down in a chair and going up and down stairs.

There is no known cure for OA, and the aim of treatment is to minimize the disease symptoms.[6] Non-pharmacological treatments have been studied for the management of OA. Aerobic exercise programs, such as walking, have been studied in numerous trials, mostly in individuals with knee OA, and have been demonstrated to increase functional and aerobic capacity and decrease pain, fatigue, depression and anxiety.[1,7] Moreover, they modulate the inflammatory component of disease in older adults with kOA.[8,9,10] However, despite ample evidence suggesting that aerobic exercise is effective in reducing the symptoms of kOA, the prescribed exercise protocol (intensity, frequency and duration) varies widely, hindering the specification of an appropriate dose. To optimize a patient's chances of improvement, a controlled protocol based on progressively larger workloads must be prescribed.[11]

Aquatic exercises have been widely used as kOA treatments because the body's buoyancy in water reduces the weight that joints have to bear.[12] Studies have also shown that moderate-intensity aerobic walking on land reduces pain and disability in subjects with knee OA with no adverse effects on OA symptoms.[13,14] Given that both of these methods have been demonstrated to be effective, some studies have compared aquatic to land-based exercise interventions.[2,14]

However, although walking exercises are a popular form of physical activity and a convenient option to prevent chronic diseases, with no cost to practitioners, the effect of an exercise program solely based on walking on physical and functional parameters, quality of life and self-report of the disease state in elderly women with knee osteoarthritis is unknown.[15] Furthermore, despite ample evidence suggesting that walking exercise training is effective in reducing the symptoms of knee OA, the prescribed exercise protocol (intensity, frequency and duration) varies widely, making it difficult to specify the appropriate dose.[11] Therefore, the aim of this study was to investigate the effects of a training program consisting of walking using a controlled progressive workload in water compared with a similar program on land in terms of pain, functional and physical performance, and quality of life.

Materials and methods

Ethical statement

This study was conducted in accordance with the ethical principles for research involving humans (Resolution 196-96 of the National Health Council of the Brazilian Ministry of Health) and was approved by the Universidade Federal dos Vales do Jequitinhonha e Mucuri Ethics Committee (protocol 057/08).

Study Design

This is a randomized-controlled trial in which the dependent variables were assessed before and after training. The study was a randomized single-blind trial to evaluate and to compare the effectiveness of aerobic training programs in water versus on land in elderly women with kOA.

Participants

To be eligible to participate in the study, subjects had to meet the following criteria: age over 60 years; diagnosis of OA in at least one knee, based on clinical and radiographic criteria of the American College of Rheumatology, the gravity of the kOA being classified radiographically on the Kellgren & Lawrence scale;[16] no recent trauma of the knees; no use of any aid for locomotion; no procedure for rehabilitation of the lower limbs in the last three months; physical condition and cognitive state assessed using the Mini-Mental Status Examination (MMSE),[17] meeting minimum requirements for physical activity; no contagious skin conditions; no use of glucocorticoids for at least two months; no use of beta-blocker drugs; and no regular exercise.

One hundred and eight volunteers were recruited through a physiotherapy clinic and as a result of medical referrals. After initial contact, many potential participants were excluded because they did not meet the inclusion criteria, use of steroidal anti-inflammatory medications and/or beta-blockers, and for declining to participate. Finally, after giving informed consent, 16 volunteers completed all the experimental procedures. These individuals were divided by randomized allocation into either a land-based (N = 8) or a water-based exercise group (N = 8) (Figure 1).

For allocation of participants, a 1:1 ratio randomization was performed using opaque envelopes for the concealment of allocation. In order to minimize the chance of bias we used envelopes that were: a) opaque, sealed and serial numbered; b) opened sequentially and only after the participant's name and further details were written on the envelope; and c) stored in a locked and secure place. The allocation sequence was concealed from the researcher enrolling and assessing participants in sequentially numbered, opaque, sealed envelopes. Only one researcher was aware of the group assignment performing the randomization.

Experimental procedures

The experiments were performed at the UFVJM laboratory of physiology of exercise and at the Santa Casa de Caridade de Diamantina Hospital. Volunteers were evaluated by an examiner, who was blind to group assignment, immediately before the training programs began and again after 12 weeks of land-based or water-based aerobic training. Anthropometric measures and specific tests were performed during the experiment.

Interventions

The land-based sessions were held in a gymnasium, while the water-based sessions were conducted in a 30-square-meter heated pool that was 1.20 meters deep. The sessions were always conducted in the afternoon, three times per week, for a period of 12 weeks, and the sessions were controlled in terms of the progression of time and intensity where the walking intensity was monitored based on the target heart rate

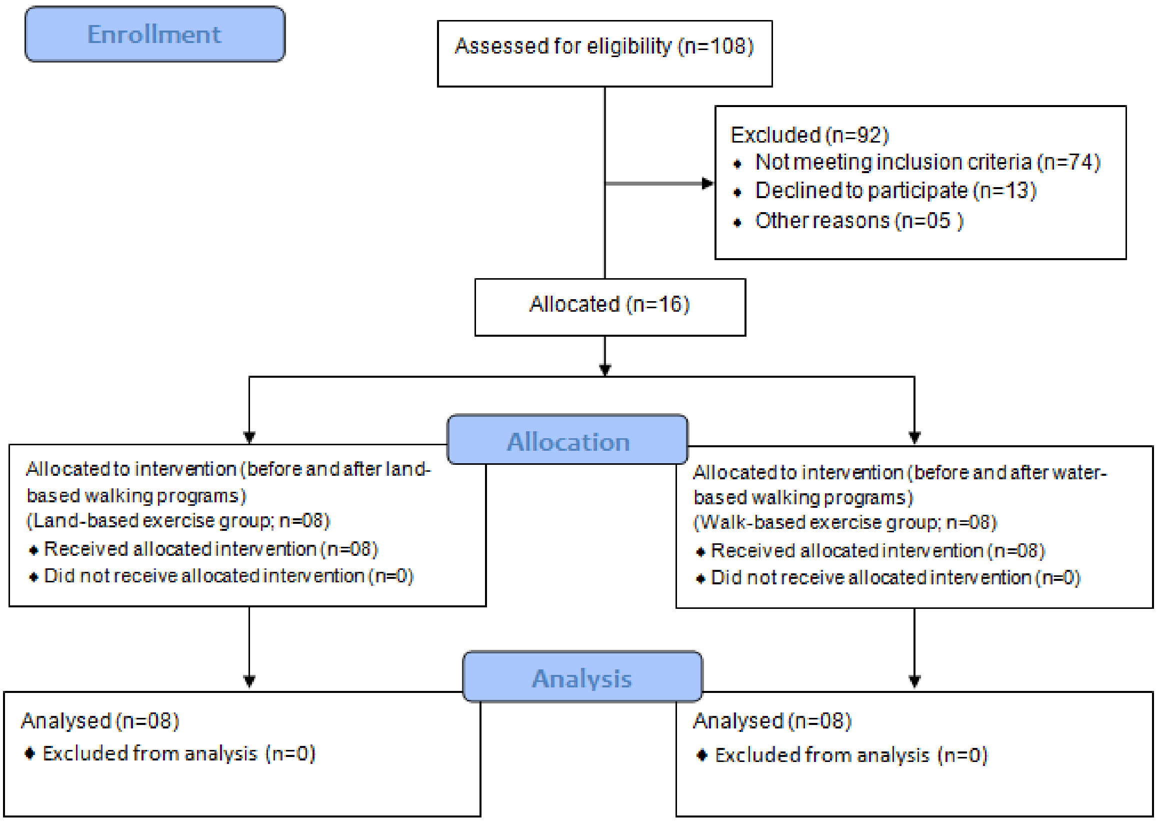

Figure 1. Study flowchart

of each volunteer, which was monitored by a heart rate monitor (Polar, model F4). The training program of both intervention groups started with exercise intensity of 70-75% HR_{max}, and was increased to 75-80% of HR_{max} at week 3, and progressed to 80-85% at week 5, being maintained at this level until the end of the training program. During each training session, each participant's heart rate was checked and recorded every three minutes to ensure that heart rate was maintained within the range previously determined (target heart rate ± 5 bpm). Each training session was divided into three phases: 1 - warm-up (5 minutes): stretching exercises; 2 - training (30 - 55 minutes): walking at the target heart rate; 3 - cool-down (5 minutes): walking slowly at a comfortable pace for the land group and performing leg beats with buoys and/or holding the bar along the edge of the therapy pool in the water group. The training program started with 30 minutes of exercise with a 5-minute progression every 2 weeks, ending with 55 minutes in the last weeks of training. (Table 1)

Table 1. Training program with progressive and controlled loading used for Land-Based Group (N = 8) and Water-Based Group (N = 8)

Weeks	Intensity of exercise	Duration of exercise
1 -2	70 - 75 % of HRmax	30 min.
3- 4	75 - 80% of HRmax	35 min.
5	75 - 80% of HRmax	40 min.
6	80 - 85% of HRmax	40 min.
7-8	80 - 85% of HRmax	45 min.
9-10	80 - 85% of HRmax	50 min.
11-12	80 - 85% of HRmax	55 min.

Legend: HRmax: maximum heart rate.

Specific tests used

All tests used in this study were performed by the same examiner, who was blinded with respect to group assignment. The tests were performed on the same day, in the morning, in the following order: the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) were conducted first, followed by the stair test (ST) and the six minute walk test (6MWT), with 10-minute intervals between each test. The tests were applied before and 24 hours after the intervention period.

The physical test was performed 24 hours after the test of functional performance, always in the morning. Prior to performing the functional and physical tests, the participants were instructed to wear comfortable clothing and shoes, drink 500ml of water, eat a light meal and avoid strenuous activity for at least two hours. The tests were given two days before the start of training and participants were retested 2 days after the end of the training program. During completion of the WOMAC index, in cases of bilateral OA, the participants were asked to consider the symptoms of pain, stiffness and physical function in the knee mentioned in the first evaluation.

Outcomes

In accordance with the recommendations of the Outcome Measures for Arthritis Clinical Trials, the primary outcome measures for this investigation were self-reported pain assessed by the WOMAC, 6MWT, ST, maximum oxygen consumption (VO2max), and anaerobic threshold (AT).[18] Secondary outcomes included assessment of life quality using the SF-36.[19,20]

WOMAC

The WOMAC questionnaire is specific for OA, has been validated for use in the Brazilian population, and includes questions related to the individual's perceptions of pain, joint stiffness and level of physical activity (functionality) over the previous 72 hours.[21]

Functional performance test

6MWT: This test measures the distance that an individual is able to walk in six minutes. The participant was instructed to walk as quickly as possible (without running) over a course. If necessary, the participant could stop to rest and then resume walking. After six minutes, the participant was instructed to stop and the distance covered was recorded.[22]

ST: This test measures the time required for the participant to climb up and down four steps, each 10 cm high. The participant moved up and down the stairs as quickly as possible, and the time required to complete all stairs was recorded.[23]

Physical performance tests

To quantify physical performance, a progressive exercise test until fatigue was performed on a treadmill (Inbramed, classic model). A modified Naughton and colleagues[24] protocol was used. The heart rate was recorded at 30-second intervals during the test using a heart rate monitor (Polar, F4 model), and Borg´s rating of perceived exertion (RPE) scale was administered every 3 minutes during the test.[25] The test was stopped, and maximal exertion was said to be reached if a score of more than 18 on the Borg scale (RPE) and/or volitional fatigue was reported.[25] In addition, the test was discontinued in the event of dizziness, nausea, blurred vision, dyspnea, chest pain, diastolic blood pressure elevated to 120 mmHg, sustained drop in systolic blood pressure (SBP) or marked elevation of SBP to 260 mmHg. The VO2max was calculated based on the slope grade (G) and speed (S) during the last stage of the test completed by the subject according to the following equation:[26] VO2 = (0.1 x S) + (1.8 x S x G) + 3.5.

To determine the AT, lactate in peripheral blood was collected for identification of AT every 3 minutes during the progressive test by puncturing the fingertip using disposable lancets. Lactate was immediately determined via spectrophotometry using reagent strips inserted into a lactimeter (Accusport, Accutrend Plus). AT, which represents the level of intensity of physical exercise at which energy production by aerobic metabolism is first supplemented by anaerobic metabolism,[27] was determined by applying the bisegmental linear regression mathematical model of Hinkley's algorithm to VO2max data.[28]

Quality of Life

Quality of life was assessed using the SF-36, a multidimensional questionnaire comprising 36 items that evaluate areas related to health. For each area, the possible scores range from 0 (worst health status) to 100 (best health), with a higher score indicating a better quality of life.[19,20]

Intraclass Correlation Coefficient of Measurements

Prior to the beginning of the study, intra-examiner reliability was calculated for WOMAC, 6MWT, ST and physical performance tests. For this pilot study, fifteen volunteers performed the tests on two separate days, with an interval of at least 24 hours between tests. The intraclass correlation coefficients (ICC) were 0.635, 0.821, 0.796 and 0.820 WOMAC, 6MWT, ST and VO2max, respectively.

Statistical Analysis

The variables with normal distributions according to a Shapiro-Wilk test were submitted to repeated measures analysis of variance (ANOVA) followed by Tukey *post hoc* comparisons. The factorial design with repeated measures was justified by the use of two treatments, land- and water-based exercise, and measurements taken at two points in time: before and after intervention. For the variables that were not normally distributed, the statistic utilized was the ANOVA type statistic (ATS), which has, based on asymptotic theory, an approximate F distribution under the null hypothesis.[29] The approximation developed by Brunner and Puri[29] was proposed for very small sample sizes and ordinal data based on the ideas of Box. Nonparametric analyses were carried out using Statistical Analysis System (SAS Institute, Cary, NC, USA) software and free macros for the SAS and R statistical systems. Main effects, interactions and other contrasts were tested with ATS of the ranks. In this study, the significance level was set at $P < 0.05$, and the analyses were carried out in SAS.

Sample size: The sample size necessary to detect a minimal relevant change was calculated considering a significance level of 0.05 and statistical power of 0.8. Therefore, it was calculated that at least 7 participants would be required in each group.

Results

Participant characteristics

In the present study, all 16 initial volunteers completed the course of experiments, and no significant differences were observed in anthropometric characteristics between the two study groups before or after intervention (Table 2).

Data adherence and retention

All volunteers completed all the experimental tasks (adherence rate = 92%), attending an average of 33 sessions of a total of 36 offered. There were no significant differences between subjects or between groups.

Outcome

Self-reported pain, assessed by WOMAC, showed a significant reduction after 12 weeks of training compared to before the beginning of the intervention program, both in the land-based (41.82%) and water-based groups (46.94%) (Figure 2A).

Table 2. Anthropometric variables and classification of radiographic knee OA

Variable		Land-Based (N=8) Mean±SD		Water-Based (N =8) Mean±SD	
		Before training	After training	Before training	After training
Age (years)		68±6	68±6	67±3	67±3
Height (m)		1.56±0.07	1.56±0.07	1.52±0.07	1.52±0.07
Weight (kg)		69.15±12.57	68.19±12.16	64.20±10.46	63.03±10.83
BMI (kg.m-2)		28.70±5.39	28.38±5.50	27.56±2.05	27.10±2.54
Gravity of the knee OA (N)	Grade I-II	5		4	
	Grade III-IV	3		4	

The data are presented in mean ± standard deviation. Legend: BMI: body mass index; OA: osteoarthritis.

Self-reported physical function, also assessed by WOMAC, showed a statistical improvement after training compared to before training, both in the land-based (43.48%) and water-based groups (60.50%) (Figure 2B).

Self-reported stiffness did not improve after training compared to before the intervention in either group (Figure 2C). In the three WOMAC domains, no difference between the land-based and water-based groups was observed.

Functional performance, evaluated directly by the 6MWT and ST, improved significantly in both groups, with no significant difference between groups. The distance walked during the 6MWT increased by 15.38% after 12 weeks of training in the land-based group and by 11.23% in the water-based group (Figure 3A). The time required to walk up and down four steps in the ST decreased by 14.81% after the intervention in the land-based group and by 7.71% in the water-based group (Figure 3B).

After completion of a progressive test on a treadmill until fatigue, physical performance was determined in terms of the VO2max and AT. The VO2max increased significantly in the land-based (7.04%) and water-based

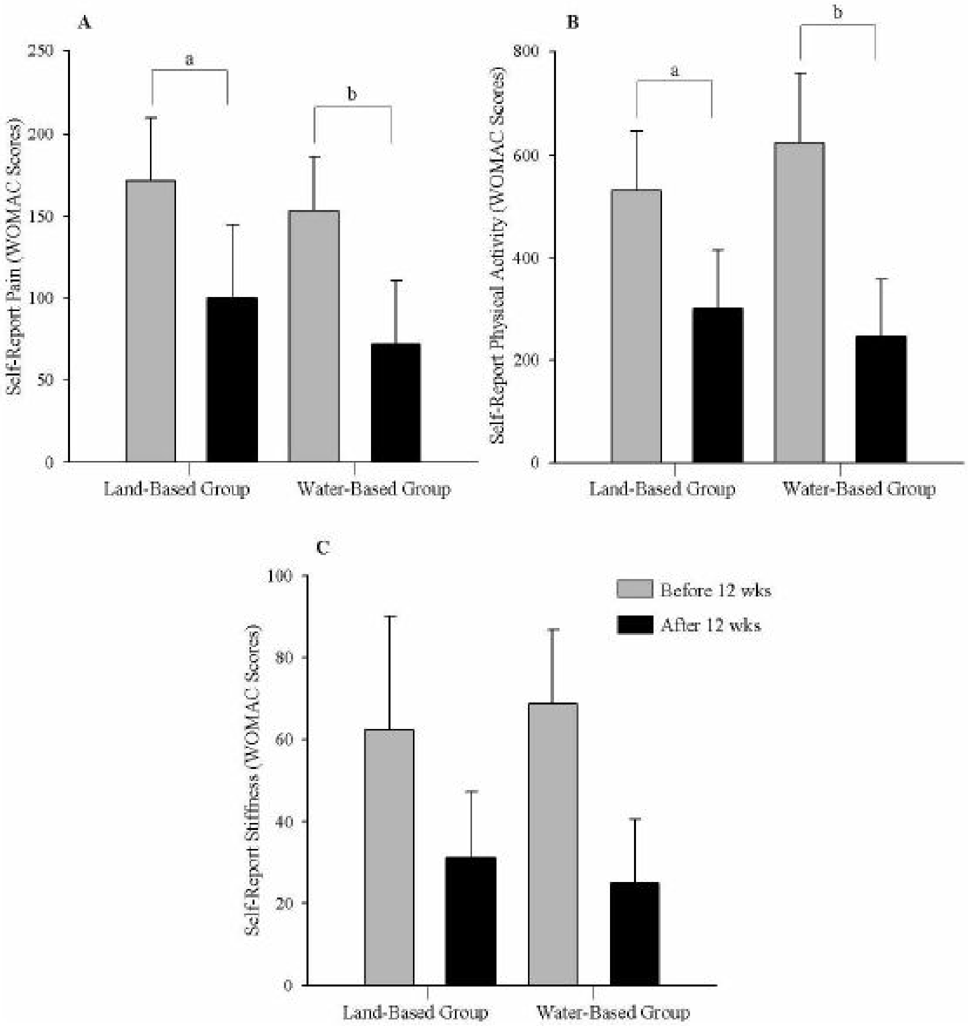

Figure 2. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for the land-based group (*N* = 8) and water-based group (*N* = 8). A, Self-reported pain (*P* = 0.016); B, Self-reported physical function (*P* = 0.011); C, Self-reported stiffness (*P* = 0.113). [a]Significant effect after training in the land-based group compared to before intervention; [b]Significant effect after training in the water-based group compared to before intervention. Values shown are the mean ± standard error

groups (12.20%) after 12 weeks of training compared with before intervention, with no difference between groups (Figure 3C). Moreover, AT was reached at higher exercise intensity and, therefore, at higher oxygen consumption after the intervention in the land-based group (7.75%) and in the water-based group (9.80%), with no difference between groups (Figure 3D).

Quality of life, assessed by SF-36, showed improvement in 7 of 8 questionnaire domains, except social function, compared to before the intervention. However, there was no significant difference between groups in any domain (Table 3).

Discussion

Both land and water-based exercise training programs were effective in reducing self-reported pain and disability, improving functional and physical performance, and increasing quality of life in elderly women with kOA. To the best of our knowledge, the present study was the first randomized clinical trial that compared matched aerobic training programs performed on land and water in elderly women with knee OA. This training intensity control allowed us to evaluate the specific effects of each intervention in

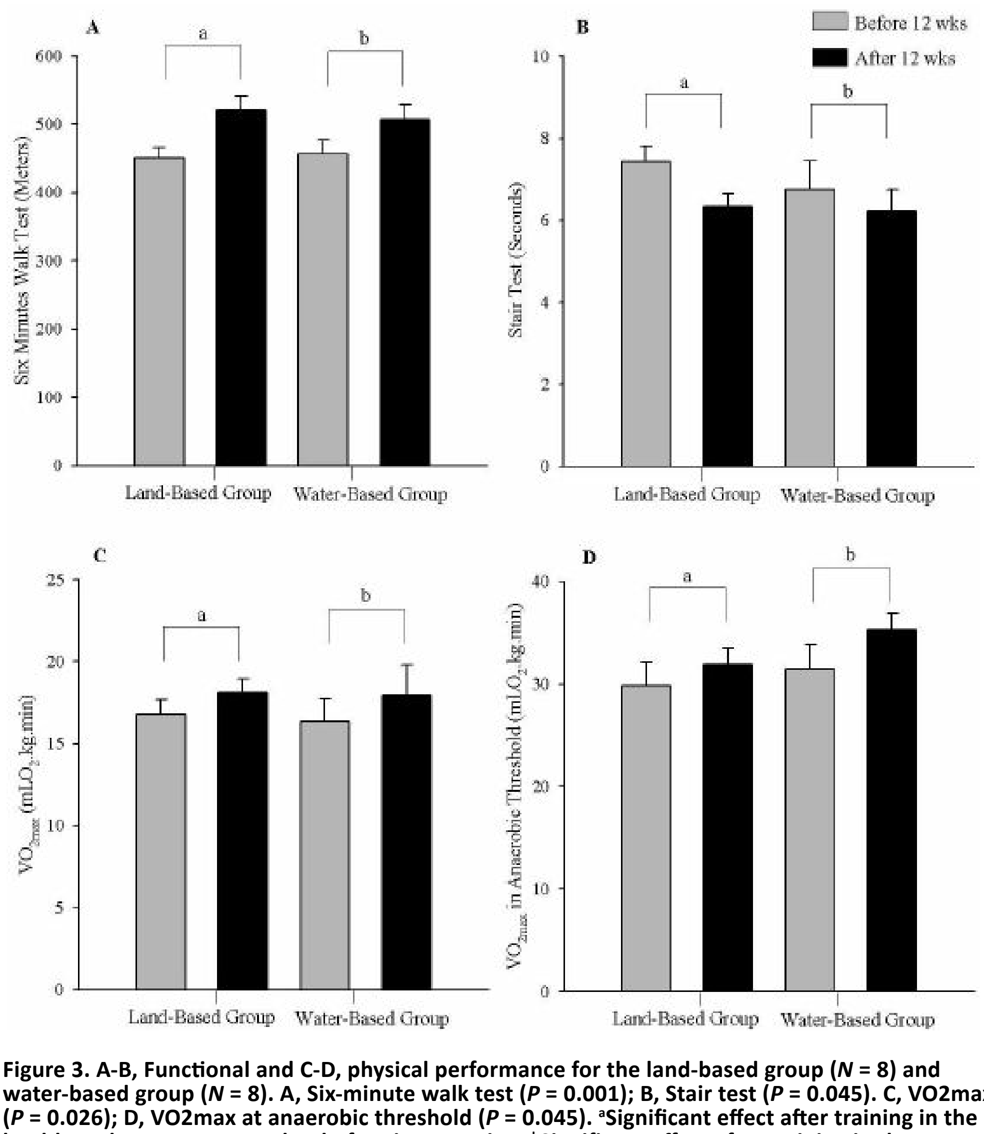

Figure 3. A-B, Functional and C-D, physical performance for the land-based group (*N* = 8) and water-based group (*N* = 8). A, Six-minute walk test (*P* = 0.001); B, Stair test (*P* = 0.045). C, VO2max (*P* = 0.026); D, VO2max at anaerobic threshold (*P* = 0.045). [a]Significant effect after training in the land-based group compared to before intervention; [b]Significant effect after training in the water-based group compared to before intervention. Values shown are the mean ± standard error

Table 3. Quality of life measured by SF-36

SF-36 Domains (%)	Land-Based (N = 8)		Water-Based (N = 8)		p
	Before Training	After Training	Before Training	After Training	
Physical Function	54.38 ± 5.12	75.00 ± 3.53*	41.88 ± 7.61	70.00 ± 3.53*	<0.001
Physical Role	50.00 ± 10.56	90.63 ± 4.57*	46.88 ± 12.88	81.25 ± 4.09*	<0.001
Body Pain	37.13 ± 6.40	63.38 ± 2.50*	41.88 ± 9.14	65.00 ± 3.42*	<0.001
Vitality	57.50 ± 5.26	74.38 ± 3.83*	49.50 ± 4.10	74.38 ± 4.86*	<0.001
General Health	44.63 ± 4.68	63.25 ± 3.24*	51.63 ± 3.92	68.25 ± 3.86*	0.001
Mental Health	63.00 ± 5.89	82.00 ± 2.00*	67.50 ± 6.56	77.50 ± 6.23*	0.001
Emotional Role	49.99 ± 12.59	91.65 ± 5.46*	58.33 ± 16.36	83.33 ± 12.59*	0.009
Social Function	57.81 ± 6.65	82.81 ± 6.22	56.25 ± 12.49	65.63 ± 5.66	0.087

*Significant effect after training in the Land-Based Group compared to before intervention; # Significant effect after training in the Water-Based Group compared to before intervention. $p < 0.05$; Mean ± Standard Error.

patients undergoing a similar physiological demand. Thus, because we formally measured and controlled exercise intensity, we believe that the exercise dosage produced physiological changes in both training groups. Moreover, every effort was made to ensure that the intensities of both programs were similar by providing instructions to all patients to ensure control of their exercise workload. In addition, a single treating physiotherapist oversaw the training program. The high level of adherence achieved is also noteworthy and compares favorably with other kOA rehabilitation trials.[30] This high compliance was in part attributable to phone call follow-ups by the treating physiotherapist that motivated patients to continue the training program.

In the present study, we chose to use an aerobic training protocol based exclusively on walking because it is a pleasant exercise modality, easy to execute and usually inexpensive, which contributes to the choice of walking on land as a modality for the non-pharmacological treatment for kOA. Moreover, this training intensity provides important adaptations in the cardiorespiratory and muscular system that, after a certain period of training, improves the capacity to capture, transport and use oxygen through trained muscles. These adaptations increase the muscle's potential to generate adenosine triphosphate aerobically, as well as increasing regional blood flow in the trained tissue, due to the more effective distribution of cardiac output and increased capillary microcirculation. Thus, this intensity of exercise brings benefits to the body, by reducing blood pressure, strengthening the heart muscle, reducing the risk of cardiovascular disease, while increasing the quality of life and life expectancy of individuals.[31,32] These studies are in line with studies from our group that showed that land-based walking training programs improve plasmatic concentrations of sTNFR1, BDNF, as well as stimulating leukocyte production with consequent improvement in functional capacity and quality of life in elderly women with kOA.[8,9,10]

It is noteworthy that the exercises performed in this study involved several muscle groups and forms of exercises for overall muscle endurance, especially in the lower limbs. Moreover, since walking exercises are a popular form of physical activity and a convenient option to prevent chronic diseases, at no cost to practitioners, the effect of an exercise program based solely on walking on the physical and functional parameters, pain, and quality of life in elderly women with knee osteoarthritis is not known. In addition, despite ample evidence suggesting that walking exercise training is effective in reducing the symptoms of knee OA, the proposed exercise protocols do not clearly define the quantity and quality of the stimulus to be applied during treatment.[33,34] Thus, the absence of control variables (volume and intensity) and the progressive nature of training has been a major limitation of previous studies that have addressed the effects of walking in patients with osteoarthritis (OA) of the knee.[30,35] This limitation has led to conclusions that recommend walking for the treatment of OA, but do not clearly define the quantity and qualities of the stimuli to be applied throughout the treatment. We therefore performed individualized and progressive adjustments of the workload as the individual adapted to the stimulus of exercise.

Conclusion

In conclusion, we highlighted that, regardless of the type of intervention (land-based or water-based), once all subjects exercised with the same intensity and same amount of exercise during each week of training, neither mode was clearly superior to the other. Because land-based walking training was as effective as water-based walking training, we believe that land-based walking training constitutes a more cost-effective choice for public health programs for the treatment of elderly patients with kOA.

Limitations

The limitations of this study should be considered in interpreting the results. Although the sample size was relatively small, significant differences were found in both treatments. Therefore, the present results need to be confirmed in a larger sample. So, further studies are needed to analyze clinical outcomes for aquatic or terrestrial walking exercise in patients with knee OA.

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