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Aquatic exercise in a chest-high pool for hormone therapy-induced arthralgia in breast cancer survivors: a pragmatic controlled trial

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Abstract

Objective: To investigate the impact of aquatic exercise on pressure pain threshold in breast cancer survivors with hormone therapy-associated arthralgia.

Design: Single-blind, controlled trial.

Setting: Two major metropolitan hospitals and a Sport and Spa Club in Granada, Spain.

Subjects: Forty women aged 29–71 years with stage I–III breast cancer who reported arthralgia.

Intervention: Patients were allocated alternately to either aquatic exercise in a chest-high pool or usual care while on the waiting list; control patients received treatment later. The two-month hydrotherapy intervention consisted of 24 sessions 3 days per week. Each session included 5 minutes of warm-up, 15–20 minutes of aerobic exercise, 15 minutes of mobility exercise and 20 minutes of recovery techniques.

Main measures: Pressure pain threshold at neck, shoulder, hand and leg were evaluated as primary outcomes. Cancer-related fatigue, as measured by the Piper Fatigue Scale, body mass index and waist circumference were secondary outcomes. A 2 × 2 repeated-measure ANCOVA was used in this study.

Results: No adverse events or development of worsening of pain was observed. Almost all the participants in the intervention group (89%) adhered to the hydrotherapy programme. Participants experienced a decrease in pressure pain threshold measured in neck, hand, shoulder and leg, as measured by algometry pressure, and waist circumference; all $P < 0.05$. Cancer-related fatigue ($P = 0.06$) and body mass index ($P = 0.42$) did not show significant improvement.

Conclusions: These data suggest that hydrotherapy in a chest-high pool may reduce the pain threshold and waist circumference in breast cancer survivors with hormone therapy-associated arthralgia.

Keywords

Cancer, exercise, fatigue, hydrotherapy

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Introduction

Hormone therapy for carcinoma of the breast may be associated with debilitating arthralgia in a small proportion of users. The actual incidence of arthralgias or musculoskeletal symptoms in breast cancer survivors using hormone therapy is not known, though such symptoms have been reported to be between 5% and 50%.[1,2] These arthralgias appear more commonly with aromatase inhibitor than with tamoxifen.[3–5] Nevertheless, a recent study has stated that arthralgia is a debilitating symptom consistently reported by a small, yet significant, proportion of tamoxifen users,[6] with a profile similar to that of examestane (third generation of aromatase inhibitors) with respect to arthralgia incidence.[7]

Arthralgia is one of the most prevalent causes reducing adherence to hormone therapy in breast cancer patients.[8,9] Clinicians have tried a variety of interventions, though it is not clear that any of these interventions has had a dramatic effect on these symptoms.[4] A possible treatment option for arthralgia may be gentle exercise. Yoga intervention has shown effectiveness in reducing pain and improving balance and flexibility in breast cancer survivors with arthralgia.[10] This study was limited due to a lack of an adequate control group.

Aquatic exercise is a popular non-pharmacologic modality used for treating a variety of conditions, including musculoskeletal pain.[11] The pain-relieving properties of hydrotherapy may be mediated by buoyancy that significantly decreases weight bearing and stress on weight-bearing joints, bones, and muscles.[12] Clinical trials have found that patients with different conditions such as fibromyalgia,[13] pain associated with multiple sclerosis,[14] rheumatoid arthritis[15] or osteoarthritis[16] have less pain when hydrotherapy is used as a pain-relieving treatment. Different resources have been used, such as a deep-water pool in low back pain patients,[17] but other possibilities such as a chest-high pool have not been explored previously. As research in this area is limited, we conducted a preliminary study evaluating the use of hydrotherapy to relieve hormone therapy-associated arthralgia in breast cancer survivors.

Obesity[5] and cancer-related fatigue[18] have been associated with an increased incidence of muscle pain and arthralgias in breast cancer survivors. To the best of our knowledge, there are no previous studies analysing the effectiveness of hydrotherapy in improving body composition and cancer-related fatigue, as secondary outcomes, in breast cancer survivors using hormone therapy.

The specific aim of this study was to investigate the impact of aquatic exercise on pressure pain threshold, cancer-related fatigue and waist circumference in breast cancer survivors suffering hormone therapy-associated arthralgia.

Methods

The present study was a pragmatic, parallel group, controlled trial with allocation of participants into intervention ($n = 20$) or waiting list ($n = 20$, control group), according to order of arrival. Due to ethical reasons, it was not possible to randomize the patients. We had an ethical obligation with the Y010 Sport Centre to provide treatment to all patients willing to participate in the study, but due to limitations of resources we created a waiting list. For those subjects in the waiting list, data collected only during the control period were included in the current analysis. Throughout the study, all participants (including those in the control group) were encouraged to maintain their normal dietary habits. Control patients received treatment later. All patients gave informed consent for the study. This investigation was reviewed and approved by the University Hospital Virgen de las Nieves, Granada, Spain.

We recruited eligible patients from University Hospital Virgen de las Nieves and Hospital Clínico San Cecilio, Granada (Spain). Patients were recruited by two oncologists from the breast cancer unit. Because special facilities were required in this study (chest-high pool and complementary equipment) we contacted the Y010 Sport Club to carry out the study. Potential participants included Spanish-speaking women aged 18 years or older with stage I, II or IIIa breast cancer; and who were currently receiving aromatase inhibitors (anastrozole, letrozole or exemestane) or tamoxifen. Participants had to have had

joint pain attributable to hormone therapy following previous description of this syndrome.[4] Briefly, patients reported bilateral onset with symmetrical pain/soreness in their hands, knees, hips, lower back, shoulders and/or feet, with a score of at least 3 or more on an 11-point numerical rating scale[19] in the preceding two weeks together with early-morning stiffness and difficulty sleeping. Exclusion criteria included metastatic breast cancer (stage IV), having completed chemotherapy or radiation therapy less than four weeks prior to enrolment, joint pain attributed to inflammatory arthritis (such as rheumatoid arthritis, osteoarthritis or gout), having severe pain or non-inflammatory arthralgia prior to hormone therapy.

The two-month hydrotherapy intervention consisted of 24 sessions 3 days per week. The hydrotherapy intervention was carried out in an indoor pool sized 20 × 6 m, with 140 cm water depth, 30 ± 2°C of water temperature, and 33°C of room temperature. During this session, the participants also familiarized themselves with the use of the Borg Scale, which is a simple and reliable[20] method of rating perceived exertion used to control level of intensity during an exercise programme. Each aquatic therapy session lasted 60 minutes. A trainer exercise specialist and three physiotherapists supervised the participants. They were familiar with oncology exercise interventions. Each session included 5 minutes of warm-up, 15–20 minutes of aerobic exercise, 15 minutes of mobility exercise and 20 minutes of recovery techniques.

The aerobic exercises incorporated large muscle mass and consisted of different displacements, such as forward and backward jogging with arms pushing, pulling and pressing, leaps, leg crossovers and hopping movements focusing on travelling in multiple directions.

The mobility resistance exercises progressed throughout the programme by changing the number of repetitions per set (volume) and maximum range of motion without pain. Exercises were carried out at a reduced velocity and with appropriate axis orientation. Exercise included all possible joints implied in arthralgia induced by hormone therapy.

Participants were previously trained to relax by performing diaphragmatic breathing and concentrating on their breath. Massage techniques including superficial longitudinal strokes and local pressure over pain area were applied. Finally, full-body stretching exercises were performed at the end of each session. Participants followed usual care recommended by the oncologist in relation to a healthy lifestyle.

Sample size determination was performed with a software program (Tamaño de la Muestra 1.1, Madrid, Spain). The calculation was based on detecting between groups significant clinical differences of 20% on pressure pain threshold levels[21] with a level of 0.05, and a desired power of 80%, and an estimated interindividual coefficient of variation for pressure pain threshold measures of 20%. This generated a sample size of at least 16 participants per group. To accommodate possible dropouts before study completion, a total of 20 participants were included.

At the baseline and at the end of the eighth week, all patients were assessed for outcome variables. Pressure pain thresholds were used as the primary outcome variable as they have a reliable and adequate relationship with perceived joint pain.[21,22] Pressure pain threshold, defined as the minimal amount of pressure where a sensation of pressure first changes to pain,[23] was assessed with an electronic algometer (Somedic AB, Farsta, Sweden). The pressure was applied at a rate of approximately 30 kPa/s with a 1-cm^2 probe. Participants were instructed to press the switch when the sensation first changed from pressure to pain. The mean of three trials was calculated and used for the analysis. A 30-second resting period was allowed between each trial. The reliability of pressure algometry has been found to be high (intraclass correlation coefficient: 0.91, 95% confidence interval (CI) 0.82–0.97).[24] Pressure pain threshold levels were assessed over C5–C6 zygapophyseal joints, deltoid muscles (shoulder area), second metacarpals (hand area) and tibialis anterior (leg area) muscles by an assessor blinded to the allocation of the participants.

Cancer-related fatigue and body composition were assessed as secondary outcomes.

To assess cancer-related fatigue we used the Piper Fatigue Scale following recent guidelines.[25] The Piper Fatigue Scale is a validated tool assessing

cancer-related fatigue, and it was selected for its particular focus on related fatigue and pain.[26] The Piper Fatigue Scale is a scale with 22 numerical items assessing fatigue experienced by the patient. Using a 0–10 numerical scale, the Piper Fatigue Scale measures four dimensions of subjective fatigue: behavioural/severity, affective meaning, sensory and cognitive/mood. The total fatigue score is calculated by adding the four subscale scores and dividing this sum by 4.

Height (in centimetres) was measured using a stadiometer (Seca 22, Hamburg, Germany). Body mass index was calculated as weight (in kilograms) divided by height (in square metres). Waist circumference (in centimetres) was measured twice with a tape measure (Gulick; Creative Health Products, Ann Arbor, MI, USA; range 0–150 cm) at the midpoint between the lower border of the ribs and the upper border of the iliac crest. Both measurements were averaged.

Statistical analysis

Statistical analysis was performed using SPSS statistical software, version 19.0 (SPSS Inc., Chicago, IL, USA). To probe comparability of the groups, Student *t*-tests and chi-square tests were used to examine the differences in baseline socio-demographic and medical features between included patients. A one-way analysis of variance (ANOVA) was conducted to compare the baseline level of study variables.

The main analysis examined whether differences (mean differences) at baseline and eight weeks post treatment existed between hydrotherapy programme and control groups in all outcomes. A 2 × 2 mixed-model repeated-measure analysis of covariance (ANCOVA) with time (pre, post intervention) as the within-subjects variable, intervention (hydrotherapy programme, control group) as the between-subjects variable and age, civil status, educational level, type of hormone therapy, occupational status and clinical features as covariates were used to examine the effects of the intervention on the each study variable. Separate ANCOVAs were done with each outcome as dependent variable. The hypothesis of interest was intervention × time interaction. When an interaction was found, the inter-group effect size was calculated according to Cohen's *d* statistic.[27] An effect size <0.2 reflects a negligible difference, between ≥0.2 and ≤0.5 a small difference, between ≥0.5 and ≤0.8 a moderate difference, and ≥0.8 a large difference.

Results

Sixty-two patients were eligible for pre-screening and 40 (72.5%) were included. All patients underwent axillary lymph node dissection during the surgery. No significant differences in socio-demographic and medical features were found among the 40 patients (72.5%) included and the 22 patients (27.5%) who were excluded or declined to participate, except that a greater number of excluded/declined patients were married (12 (30%) vs. 15 (68.2 %), $P < 0.05$)) (Figure 1). In addition, 12 (30%) participants were taking analgesics (paracetamol) to control increased pain. No patients received any other exercise intervention during the study. There were no differences in age or clinical features between the aquatic exercise and control groups (Table 1), except in employment status, with a higher proportion of non-employed in the control group than in the hydrotherapy group (11 (55%) vs. 5 (25%); $P = 0.044$)).

Adherence to the intervention and adverse events were recorded in a clinical history for each participant after each session. Patients enrolled in the hydrotherapy group completed more than 79% of the 24 physical therapy treatments (mean ± SD number of sessions: 19 ± 3.7), showing a high adherence rate to the programme. Four participants in the hydrotherapy group showed a temporal (1–3 days) increase of pain after one session, but this event did not stop them continuing the programme. No further adverse events were reported.

In comparison to the control group, the experimental group showed a significant increase in pressure pain threshold levels over the cervical point ($F = 14.462$; $P = 0.001$), the shoulder region of the affected side ($F = 4.518$; $P = 0.043$), hand area (affected side: $F = 4.282$; $P = 0.049$; non-affected side: $F = 9.918$; $P = 0.004$) and leg area (affected

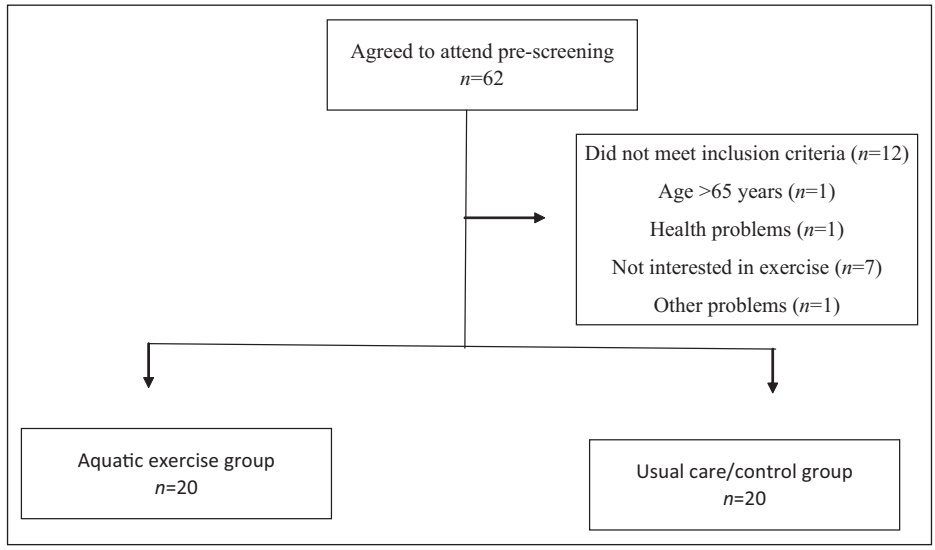

Figure 1. Flow diagram of subject throughout the course of the study.

side: $F = 8.537$; $P = 0.007$; non-affected side: $F = 9.057$; $P = 0.006$). There were no significant group × time × side interactions for pressure pain threshold levels over the shoulder area non-affected side ($F = 3.847$; $P = 0.061$). Neither covariate influenced the results. The hydrotherapy group experienced greater increases in pressure pain threshold levels bilaterally compared with the control group (Table 2). Intergroup effect sizes were large for the cervical area ($d = 1.49$) unaffected hand area ($d = 1.19$) and leg area (affected: $d = 1.30$; unaffected: $d = 1.15$). Intergroup effect sizes were moderate for the affected shoulder area ($d = 0.82$) and hand area (affected: $d = 0.79$; unaffected: $d = 0.76$).

In comparison with the control group, the experimental group did not show a significant improvement in all dimensions of the Piper Fatigue Scale: affective ($F = 0.829$; $P = 0.370$), sensory ($F = 1.476$; $P = 0.234$), cognitive ($F = 0.866$; $P = 0.360$), severity ($F = 0.316$; $P = 0.578$) and total fatigue score ($F = 3.806$; $P = 0.061$) (Table 3).

In comparison with the control group, the experimental group did not show a significant improvement in weight ($F = 0.866$; $P = 0.360$) and body mass index ($F = 0.677$; $P = 0.421$) (Table 4). In comparison with the control group, the experimental group showed a significant change in waist circumference ($F = 6.681$; $P = 0.014$). Neither covariate influenced the results. Pair-wise comparisons revealed a non-significant increase of waist circumference in the control group ($P = 0.246$) compared to a decrease in the aquatic exercise group ($P = 0.016$). Intergroup effect size was moderate for waist circumference ($d = 0.580$).

Discussion

This study confirms that breast cancer survivors with hormone therapy-associated arthralgia demonstrate an improvement in pressure pain threshold and a reduction of waist circumference after eight weeks of hydrotherapy intervention. In addition, a hydrotherapy intervention was well tolerated, with minimal side-effects. No significant benefits were observed in cancer-related fatigue.

To avoid interference with the efficacy of the drug, relief of hormone therapy-associated arthralgia through non-pharmacological strategies is welcomed. We did not find any influence of the type of hormone therapy (tamoxifen vs. aromatase inhibitors) in the analgesic effects of hydrotherapy found in this study. The origin of the arthralgias induced by aromatase inhibitors and

Table 1. Patient characteristics and comparisons between breast cancer survivors

Variable	Control group (n = 20)	Hydrotherapy programme (n = 20)	P-value
Age (years), mean (SD)	46.2 (7.4)	48.4 (10.8)	0.448
Time taking hormone therapy (months)	17.6 (6.9)	18.1 (8.7)	0.876
Civil status, n (%)			
Married	11 (55)	12 (60)	0.635
Unmarried	5 (25)	6 (30)	
Divorced	4 (20)	2 (10)	
Educational level, n (%)			
Low	7 (35)	4 (20)	0.123
Medium	4 (20)	10 (50)	
University level	9 (45)	6 (30)	
Employment status, n (%)			
Home employed	4 (20)	7 (35)	0.044*
Employed	5 (25)	8 (40)	
Non-employed	11 (55)	5 (25)	
Tumour stage, n (%)			
I	5 (25)	6 (30)	0.402
II	11 (55)	8 (40)	
IIIA	4 (20)	6 (30)	
Type of surgery, n (%)			
Tumorectomy	13 (65)	8 (40)	0.264
Mastectomy	7 (35)	12 (60)	
Type of treatment n (%)			
Radiation	0 (0)	2 (10)	0.220
Chemotherapy	1 (5)	0 (0)	
Radiation + chemotherapy	19 (95)	18 (90)	
Hormone therapy			
Tamoxifen	13 (65)	10 (50)	0.557
Aromatase inhibitors			
Anastrozole	2 (10)	3 (15)	
Lestrozole	2 (10)	4 (20)	
Eximestane	3 (15)	3 (15)	
Distribution of joint(s) pain			
Knee/hip	4 (20)	6 (30)	0.427
Wrists/hand/elbow	6 (30)	4 (20)	
Ankle/feet	5 (25)	2 (10)	
Multi-joint diffuse	5 (25)	8 (40)	
Time after surgery treatment (months)	11.15 ± 3.42	15.25 ± 9.00	0.242
Body mass index (kg m^{-2})	26.33 ± 4.42	26.91 ± 6.99	0.784

*P-values for comparisons among group based on chi-square and analysis of variance tests.

tamoxifen is not well known but could be different.[4,6] Possible mechanisms of the analgesic effects of hydrotherapy are well known; the hydrostatic effect of water can alleviate pain by reducing peripheral oedema and sympathetic nervous system activity.[28,29] In addition, we used

Table 2. Pre-intervention, post-intervention and change scores for mean values of pressure pain threshold

Group	Control	Hydrotherapy programme	Between-group differences
Cervical (kPa)			
Pre-intervention	198.99 ± 79.51	212.28 ± 66.65	–105.23 (–162.11; –48.35)*
Post-intervention	162.63 ± 37.99	281.16 ± 65.20	
Within-group change scores	–36.36 (–80.85; 8.12)	68.87 (29.33; 108.41)	
Shoulder, affected side (kPa)			
Pre-intervention	220.99 ± 102.61	233.28 ± 86.19	–56.05 (–110.25; –1.84) *
Post-intervention	219.80 ± 72.69	288.14 ± 58.55	
Within-group change scores	–1.19 (–50.92; 48.53)	54.85 (22.12; 87.58)	
Shoulder, non-affected side (kPa)			
Pre-intervention	194.21 ± 76.87	220.45 ± 68.42	– 48.82 (–99.58; 2.33)
Post-intervention	208.55 ± 83.16	283.41 ± 53.28	
Within-group change scores	14.33 (–32.93; 61.59)	62.95 (32.59; 93.32)	
Hand, affected side (kPa)			
Pre-intervention	241.85 ± 75.09	± 68.85	– 47.42 (–94.52; –0.31)*
Post-intervention	244.41 ± 58.39	297.85 ± 44.06	
Within-group change scores	2.55 (–32.37; 37.48)	49.97 (16.17; 83.78)	
Hand, non-affected side (kPa)			
Pre-intervention	±81.24	223.60 ± 65.84	–77.86 (–128.69; –27.04)*
Post-intervention	233.69 ± 74.62	283.93 ± 57.14	
Within-group change scores	–17.52 (–67.97; 32.92)	60.33 (32.94; 87.72)	
Tibial, affected side (kPa)			
Pre-intervention	41 ± 130.34	323.87 ± 63.44	–116.50 (–198.46; –34.54)*
Post-intervention	322.24 ± 97.26	434.20 ± 73.26	
Within-group change scores	–6.16 (–82.14; 69.81)	110.33 (61,46; 159.20)	
Tibial, non-affected side (kPa)			
Pre-intervention	294.52 ± 88.69	306.10 ± 52.82	–104.61 (–176.07; –33.16)*
Post-intervention	298.55 ± 96.60	414.74 ± 60.43	
Within-group change scores	4.02 (–61.69; 69.74)	108.64 (65.62; 151.66)	

Values are expressed as mean ± standard deviation for pre- and post-intervention data and as mean (95% confidence interval) for within- and between-group changes.
*Significant group × time interaction ($P < 0.05$).

warm-water spa facilities in our study. This can block nociceptors by acting on thermal receptors and mechanoreceptors and exert a positive effect on spinal segmental mechanisms.[30] Pressure algometry cannot tell us whether the reduced pain perception in this study is the result of changes in neuronal excitability or local muscle/joint response, but we can say that the improvement in sensitization process is not influenced by psychological features of the person or mediated by social aspects.[31]

The aquatic exercise programme used in this study failed to improve cancer-related fatigue with respect to usual care. These results are not unexpected, the exercise proposed in this study was focused on the analgesic effect using different mobility exercises combined with stretching and massage procedures. Only 25% of the total time was dedicated to improving the endurance of the patients. It is known that in order to reduce cancer-related fatigue, a large amount of aerobic exercise[32] and moderate resistance programme[33] are needed.

Table 3. Pre-intervention, post-intervention and change scores for mean values of Piper Fatigue Scale

Group	Control	Hydrotherapy programme	Between-group differences
Behavioural/severity			
Pre-intervention	5.82 ± 2.28	4.80 ± 2.19	0.42 (–1.12; 1.97)
Post-intervention	5.66 ± 1.95	4.21 ± 2.59	
Within-group change scores	–0.16 (–1.56; 1.24)	–0.59 (–1.43; 0.26)	
Affective/meaning			
Pre-intervention	6.48 ± 2.25	5.42 ± 2.46	0.64 (–0.80; 2.08)
Post-intervention	6.33 ± 2.27	4.63 ± 2.43	
Within-group change scores	–0.14 (–1.46; 1.17)	–0.79 (–1.56; 0.01)	
Sensory			
Pre-intervention	5.64 ± 2.44	4.71 ± 2.20	0.75 (–0.51; 2.01)
Post-intervention	6.11 ± 2.40	4.42 ± 2.39	
Within-group change scores	0.46 (–0.73; 1.66)	–0.29 (–0.90; 0.32)	
Cognitive/mood			
Pre-intervention	4.86 ± 2.22	4.52 ± 1.49	0.95 (–1.14; 3.04)
Post-intervention	5.81 ± 2.21	4.21± 2.25	
Within-group change scores	0.94 (–0.56; 2.45)	–0.01 (–1.58; 1.56)	
Total fatigue score			
Pre-intervention	5.64 ± 1.87	4.82 ± 1.80	1.08 (–0.05; 2.16)
Post-intervention	6.17 ± 1.94	4.29 ± 2.30	
Within-group change scores	0.55 (–0.55; 1.59)	–0.53 (–1.03; –0.03)	

Values are expressed as mean ± standard deviation for pre- and post-intervention data and as mean (95% confidence interval) for within- and between-group changes.
*Significant group × time interaction ($P < 0.05$).

Table 4. Pre-intervention, post-intervention and change scores for mean values of body composition

Group	Control	Hydrotherapy programme	Between-group differences
Body mass index (kg m^{-2})			
Pre-intervention	26.33 ± 4.42	26.91 ± 6.99	0.23 (–0.35; 0.81)
Post-intervention	26.66 ± 4.57	27.01 ± 7.28	
Within-group change scores	0.33 (–0.06; 0.73)	0.10 (–0.36; 0.55)	
Waist circumference (cm)			
Pre-intervention	86.96 ± 8.79	92.37 ± 19.30	3.70 (0.78; 6.62)*
Post-intervention	87.68 ± 9.49	89.39 ± 18.83	
Within-group change scores	0.72 (–0.56; 2,11)	–2.98 (–5.39; –0.56)	
Weight (kg)			
Pre-intervention	68.86 ± 10.99	69.97 ± 18.69	0.61 (–0.71; 1.93)
Post-intervention	69.61 ± 11.23	70.11 ± 19.17	
Within-group change scores	0.75 (–0.16; 1.66)	0.14 (–0.88; 1.17)	

Values are expressed as mean ± standard deviation for pre- and post-intervention data and as mean (95% confidence interval) for within- and between-group changes.
*Significant group × time interaction ($P < 0.05$).

An interesting finding of this study was the reduction in waist circumference in the hydrotherapy group compared with the control group. These results help to reinforce the evidence level regarding the ability of exercise interventions to reduce waist circumference.[34] However, the intervention failed to improve body size similarly to previous research.[35,36] The increase of physical activity level in the intervention group with respect to the control group ranged from approximately 10.2 MET to 12.2 MET per week.[37,38] This increase in physical activity level associated with a water environment favourable to high levels of energy expenditure with relatively little strain to the body[39] could promote the change in waist circumference found in our sample of breast cancer survivors.

The limitations of our single-institution study were its relatively small sample size and possible selection bias introduced by those who agree to participate in this type of study given the time requirements. In addition, the fact that this was a pragmatic design without randomization process could be considered a limitation of this study, although the observation that there was no significant difference in baseline measurement attenuated the influence of this limitation. The most common approach to pain measurement is through patient self-report scales. These scales include physiological and psychological components that could be difficult to interpret. We decided to assess pressure pain threshold to give a more focused measurement in pain perception. Finally, there are no follow-up data, which could generate doubts about whether the benefit of this programme is sustained.

In conclusion, this report is the first controlled trial establishing the use of hydrotherapy to improve hormone therapy-associated arthralgia. It should be confirmed in a larger randomized trial. Probably in the next years, arthralgia could be a major issue for breast cancer survivors with long-term use of hormone therapy. This study suggests that hydrotherapy could help to attenuate joint pain and improve body composition in breast cancer survivors.

Clinical messages

- Eight weeks of aquatic exercise programme in breast cancer survivors with hormone therapy-induced arthralgia reduce pain threshold.
- Aquatic exercise can contribute to a reduction in waist circumference. However, a programme of 24 treatment sessions carried out in a chest-high pool does not produce significant improvement in cancer-related fatigue, weight or body mass index.

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