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Effect of rowing on mobility, functionality, and quality of life in women with and without breast cancer: a 4-month intervention

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Abstract

Purpose Of the different modalities of rowing, dragon boat training is the most analyzed in breast cancer (BC). However, other types of boats, such as the felucca, use different biomechanical techniques, which have not been studied in the scientific literature. Consequently, in this study, we sought to determine the benefits of felucca rowing on the physical, psychological, and emotional well-being of patients with BC and healthy persons.

Methods A pre- and post-intervention, single-arm study without a control group with a 4-month intervention was carried out in Spain in 2019. The study sample included six women with BC and 15 healthy women. The following questionnaires were administered before and after the intervention: Disabilities of the Arm, Shoulder, and Hand (DASH), Constant-Murley score (CMS), and the European Quality of Life 5 Dimensions (EQ-5D, rate your health today). Differences were determined before and after the intervention using the paired *t* test.

Results Significant differences ($p < 0.05$) were found in the results of all the questionnaires for the women with BC and for the healthy women: DASH (-13.8 BC and -6.7 healthy), CMS ($+12.0$ BC and 9.2 healthy), and EQ-5D ($+8.5$ BC and 10.5 healthy).

Conclusion Felucca rowing showed benefits in health and quality of life in both women with BC and healthy women. In future studies with controlled design, values regarding clinical relevance, such as effect sizes/confidence intervals, are needed to corroborate our results.

Keywords Breast neoplasms · Water sports/therapeutic use · Physical functional performance · Upper extremity/physiopathology · Shoulder joint/physiopathology · Quality of life

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Introduction

In women, breast cancer (BC) is the most common cancer and is the leading cause of cancer death worldwide. The incidence of BC is estimated at 2.1 million cases in 2018, representing almost one in four cases of cancer among women. It is the leading cause of cancer death in more than 100 countries and the second leading cause of cancer death in western countries [1].

Physical activity has been shown to improve emotional and physical functioning in patients with BC [2, 3]. Interventions including exercise during cancer treatment are associated with improvements in functional ability [4], strength and sleep patterns, and a decrease in treatment-induced symptoms such as nausea, fatigue, and pain [5, 6]. By improving mood and fatigue and increasing functional capacity and physical fitness,

exercise interventions can improve the quality of life of cancer survivors and their life expectancy [7].

Women who have overcome or are recovering from BC are faced with physical sequelae, mainly in an upper limb (pain, reduced range of motion, deficiencies in muscle strength and function) [8]. Exercise has been shown to reduce and prevent the occurrence of these sequelae [2, 3, 6, 7], as well as to have positive effects on lymphedema [9, 10].

Some of these women have found rowing to be an activity that improves the disorders frequently associated with BC [11]. Rowing is one of the most complete water sports and has been shown to improve quality of life in BC patients, including psychological, physical (physical fitness and muscle strength in a comprehensive manner), social, and emotional aspects, facilitating their rehabilitation, self-esteem, and the normalization of their daily lives [8, 12, 13].

Various types of rowing exist, with the dragon boat being the main example of recreational and professional rowing in BC survivors [13]. However, there are other types of boats, such as the felucca, which is characteristic of the Mediterranean Sea. Biomechanical differences can be observed in the technical movements between the two modalities, mainly in the upper extremities. In the dragon boat, the shoulder must be flexed above the head. However, in the felucca, the movement of the arms is at shoulder height. In this type of boat, the oar is longer and is attached to the boat with a ring (oarlock), which helps to generate less tension in the upper limbs and trunk.

Considering the benefits of rowing in the dragon boat style (decreased risk of lymphedema, increased quality of life, increased myocardial function, strength and functionality of the upper limbs) [8, 12, 14–17], and that at present, to the best of our knowledge, no scientific studies have been carried out involving the felucca rowing modality, we performed an intervention study on a group of BC patients and another group of healthy women the objective of which was to determine the benefits of this type of activity, posing as a hypothesis that it would help improve the physical, psychic, and emotional statuses.

Methods

Study population, study design, participants, and intervention

The study sample comprised two groups of women between the ages of 45 and 65 years, totally untrained in rowing and with no experience in this sport. The first group included those who had suffered from BC and had received neoadjuvant and/or adjuvant treatment. The second group included women with no personal history of BC who started leisure rowing at the same time as a form of healthy and preventive exercise.

Women who were unable to perform rowing as a therapeutic activity were excluded. In accordance with the American College of Sports Medicine, reasons for this included extreme fatigue or anemia, initial wound-healing following surgery, cases of cardiopulmonary disease, and when survivors experience noticeable changes in swelling, such as during lymphedema [18]. Patients with lymphedema were recommended to use compression therapy while exercising (one woman in our sample).

This was a pre- and post-intervention, single-arm study (no control group) lasting 4 months. In January 2019, all the women who met the *Study population* criteria were contacted at the Royal Regatta Club of Alicante (Alicante, southwest Spain) to participate in a felucca rowing program once per week for an hour and a half ([Electronic Supplementary Material](#)). The study was explained to all of the women, and they were invited to participate. All the information was provided both orally, through an informative talk, and in writing. The study began in February 2019. All the participants in the boat were assessed, some of whom had BC. In other words, we were not making any comparison of the differences between women with and without BC. Consequently, we speak about two independent groups.

To begin this activity at the Royal Regatta Club of Alicante, an official medical certificate must be presented, in which it is stated that, after the tests and the electrocardiogram are carried out, she does not suffer from any anomaly that prevents her from engaging in this sport, such as metastasis (e.g., bone metastasis), polyneuropathy, or fatigue. Accident insurance is also required, as well as a monthly fee payable to the club (10–30 €/month and insurance around 70 €/year). Fatigue was an exclusion criterion because rowing is a team sport, and it is not therefore possible to individualize the work load, as all rowers need to perform the same, or almost. On dry land, though, adaptations can of course be made, but this was not the aim of our study.

The women who were invited and agreed to participate in the study were given the questionnaires, which they filled out immediately after the informative talk (see “[Variables and measurements](#)”). After 4 months, they were given the same questionnaires to be filled out again, and the measurements of all the study variables were repeated. There was no loss to follow-up.

The boat used in our study was the felucca. The crew comprises a coxswain and eight rowers in pairs, except for the stroke and bow, who are alone on their respective benches. Each of the rowers uses only one oar. The rower is seated on a fixed bench, and the torso, legs, and arms are all involved in propulsion. The oars are fastened to the bulwark of the boat through oarlocks and tethered by a natural or synthetic braided rope. The technical movement of the oars as a single overall, cyclic, and continuous movement is necessary to ensure that the boat sails evenly. This activity carried out on the sea

always encourages teamwork. Four sequences are described: catch, drive, finish, and recovery ([Electronic Supplementary Material](#) and <http://remavida.es/2020/04/28/remavida-y-umh/>). In summary, the activity was carried out once per week for an hour and a half each time, during which the rowers covered a distance of 4 to 5 nautical miles (7.4 to 9.3 km; speed from 4.6 to 6.5 nautical knots).

Variables and measurements

The main variables of this study were the scores obtained on the questionnaires Disabilities of the Arm, Shoulder, and Hand (DASH) [19], the Constant-Murley score (CMS) [20], and the last question (rate your health today) of the European Quality of Life 5 Dimensions (EQ-5D) [21]. These questionnaires were completed at the beginning and end of the study (four-month intervention).

The DASH questionnaire, validated in Spanish and with good reliability [22], consists of 30 items and evaluates functional limitation due to musculoskeletal disorders in the upper limbs [19]. Each item is scored on a 5-point Likert scale, where 1 indicates no problem and 5 indicates maximum difficulty. The overall score ranges from 0 to 100, with 100 being representative of maximum limitations. Minimal clinically important differences (MCID) are those that exceed a change of 10 points [23].

The CMS is a commonly used specific instrument for assessing the shoulder joint [24]. It includes a subjective assessment of pain, the ability to perform activities of daily living, and mobility and strength [20]. The overall score ranges from 0 to 100 points, with higher scores indicating better function [24]. A handheld dynamometer (Lafayette Instrument Company, Lafayette, IN, USA) and standardized manual muscle testing test was used to measure strength for the CMS [25]. This assessment was always carried out by the same researcher (physiotherapist) with the participant seated. The measurement was performed on the dominant arm in 90° flexion, with the elbow fully extended and the forearm in pronation, placing the instrument on the distal forearm and asking the subject to exert maximum force against resistance [25]. Three measurements were obtained, and the mean force in Newtons was calculated. The questionnaire has been validated and shows adequate reliability [26].

The EQ-5D is a generic, self-reported quality of life assessment tool [21]. The study used only the visual analog scale in which the participant indicated her general health on a scale of 0 to 100, with 100 being the best imaginable health and 0 being the worst. The validity of this scale has been tested in a BC population [27]. The EQ-5D is an appropriate tool for detecting changes in health-related quality of life after therapeutic interventions in this population [28]. An MCID of between 7 and 10 units on the visual analog scale has been reported for BC survivors [29].

The following descriptive variables were recorded for all the participants: occupation, age, body mass index, number of children, and whether they had gone through menopause. Those who had experienced BC were queried about the treatment received (surgery, chemotherapy, and radiotherapy) and whether they had upper limb lymphedema.

Sample size calculation and statistical methods

Given that no studies have been performed with the felucca boat, CMS data were obtained from two women with BC and from the five healthy women, chosen at random (pilot). These women were selected in order to estimate the parameters to be obtained (mean and correlation coefficient between the two measures): with BC (pre-test, 3.92; post-test, 10.33; correlation, 0.651) and without BC (pre-test, 3.78; post-test, 9.03; correlation, -0.109). With these data, and setting the type I error at 5% and the type II error at 10%, to compare mean differences through the *t* test for paired data, at least five women with BC and eight without BC were needed.

The variables were described using absolute and relative frequencies for qualitative variables and with means and standard deviations for quantitative variables. We analyzed whether both groups were homogeneous (with and without BC), through tests based on the chi-square (Pearson's or Fisher's) and Student *t* for independent data. To determine differences between pre- and post-intervention questionnaire scores, we applied Student's *t* test for paired data. Results were obtained separately for women with BC and women without BC. All calculations were made with a significance of 5%, and for each relevant parameter, its associated confidence interval was calculated. The statistical package used was IBM SPSS Statistics 25.

Results

Table 1 shows the descriptive characteristics of the study sample, consisting of six women with BC and 15 without BC. Both groups were similar, in that most of them worked, were postmenopausal, the dominant arm was mainly the right one, and the mean number of children was very similar (1.8 versus 1.7). However, there were statistically significant differences in mean age, with women with BC being younger than those without the disease (7.6 years difference).

The results after 4 months of follow-up are reported in Table 2. No adverse events occurred, and adherence to the exercise protocol was complete for all participants. Significant differences ($p < 0.05$) were found in the mean scores of all the questionnaires, regardless of whether the participants had BC or not. However, those with BC had greater improvements in shoulder functionality, while the increase in quality of life was slightly higher in women without BC. On

Table 1 Baseline characteristics of the study participants

| Variable | With BC (<i>n</i> = 6) <i>n</i> (%) / $x \pm s$ | Without BC (<i>n</i> = 15) <i>n</i> (%) / $x \pm s$ | <i>p</i> value |
|--------------------|---|---|----------------|
| Age (years) | 48.5 ± 3.4 | 56.1 ± 6.0 | 0.009 |
| Working | 6 (100) | 13 (86.7) | > 0.999 |
| Postmenopausal | 4 (66.7) | 13 (86.7) | 0.544 |
| Right-handed | 5 (83.3) | 15 (100) | 0.286 |
| Number of children | 1.8 ± 1.0 | 1.7 ± 0.7 | 0.671 |
| Surgery | 6 (100) | N/A | N/A |
| Chemotherapy | 2 (33.3) | N/A | N/A |
| Radiotherapy | 3 (50) | N/A | N/A |
| BC lymphedema | 1 (16.7) | N/A | N/A |
| Right BC | 4 (66.7) | N/A | N/A |

Abbreviations: BC breast cancer, N/A not applicable, *n* (%), absolute frequency (relative frequency), $x \pm s$ mean ± standard deviation

the DASH, an improvement was seen, with a decrease in the mean score by 13.8 points for women with BC and 6.7 points for those without BC. On the CMS, the scores in these two groups increased by 12.0 and 9.2, respectively. Finally, on the EQ-5D, there was an increase of 8.5 points (with BC) and 10.5 points (without BC), respectively.

Discussion

The intervention carried out in a group of patients with BC and another group of healthy women demonstrates the physical, psychic, and emotional benefits of felucca rowing once per week for 4 months.

Strengths and limitations

We stress that the statistical power of the results is very high, as statistically significant differences were found with very few participants. Furthermore, as felucca rowing is a

collaborative group activity, rowing alongside people experiencing the same health problems could foster motivation and improve the mood of the participants, allowing them to regain self-confidence and control over their physical health and emotional well-being [13]. In addition, this activity is easy to learn and does not require a particular level of physical fitness or extensive technical skills.

The limitations include the absence of a control group. Also, since this activity was voluntary, the participants had to pay for it themselves, and therefore, a clinical trial could not be carried out. Although the monthly fee is not high, not everyone can afford it. The possibility of funding this activity through the health system could be considered. Reporting bias was minimized by using validated questionnaires [19–21], and joint strength and range of motion were measured by the same researcher, using the same procedures. Finally, the intensity of the exercise was not assessed using more appropriate methods, like exercise testing, muscle strength measurements, or 6-Minute Walk Test. However, as the participants were in a real clinical practice setting, we decided to use validated self-reported questionnaires [19–21].

Comparison with the existing literature

We found no studies on exercise interventions using the felucca boat in the literature, although some studies are available on the dragon boat modality [8, 12, 14–17]. An analysis of these studies revealed that only one used the same questionnaires we administered for functionality and mobility, and this study used a different questionnaire for quality of life. However, we are unable to determine the impact of the activity, since the authors did not provide results both before and after the intervention [8], a key point in determining its effectiveness. The remaining studies [12, 14–17] assessed other types of outcomes, such as the incidence of lymphedema or cardiac function. Consequently, we cannot compare whether one type of boat produces greater improvements than another in the variables analyzed.

Table 2 Mean differences with standard deviations in the primary outcomes of the study after a 4-month intervention

| Variable | With BC (<i>n</i> = 6) | | | | Without BC (<i>n</i> = 15) | | | |
|----------|-------------------------|-------------------|--------------|----------------|-----------------------------|-------------------|--------------|----------------|
| | Pre-intervention | Post-intervention | Difference | <i>p</i> value | Pre-intervention | Post-intervention | Difference | <i>p</i> value |
| DASH | 70.8 ± 20.5 | 57.0 ± 13.2 | − 13.8 ± 7.9 | 0.008 | 43.4 ± 14.5 | 36.7 ± 6.2 | − 6.7 ± 10.2 | 0.023 |
| CMS | 70.6 ± 8.0 | 82.6 ± 3.8 | 12.0 ± 5.6 | 0.003 | 80.2 ± 9.1 | 89.3 ± 2.4 | 9.2 ± 9.2 | 0.002 |
| EQ-5D | 75.2 ± 4.1 | 83.7 ± 5.0 | 8.5 ± 2.4 | <0.001 | 78.7 ± 6.2 | 89.1 ± 4.8 | 10.5 ± 7.7 | <0.001 |

The values were described by using means ± standard deviations. EQ-5D is the question “rate your health today”

Abbreviations: CMS Constant-Murley score, DASH Disabilities of the Arm, Shoulder, and Hand, EQ-5D European Quality of Life 5 Dimensions

Implications to research and clinical practice

Our study demonstrated the health benefits of felucca rowing, although it would be advisable to carry out future studies with a control group in order to minimize possible systematic errors. Moreover, in order to recommend an intervention, a set of studies are needed that support its clinical benefit.

Because this study showed good results regarding strength, range of joint motion, upper limb functionality, and perceived quality of life, this type of exercise could be included in the guidelines for recommending physical activity in BC. This type of activity carried out in direct contact with nature could favor mutual support and empathy with the other rowers, who would perfectly understand the situation being experienced, which would contribute to the participants regaining their self-confidence and control over their physical health and emotional well-being. Finally, it is important to consider safety measures when undertaking the activity. Accordingly, in our case, the coxswain acted as the instructor, verifying the performance of the correct technique, thereby avoiding possible lesions.

With regard to the difference found in the CMS in women with BC, we obtained a value of 12 points. Although the MCID was not calculated specifically in these patients, it was established at 10.4. Considering this threshold, we can state that there was clinical improvement (12 versus 10.4 points) [23]. On the DASH, a change of almost 14 points was found in women with BC. Therefore, the intervention appears to be clinically relevant concerning functional limitation of the upper limbs. In contrast, for the healthy women, the value was close to this threshold (6.7 points). It should be noted that this group had no functional limitations at the start of the activity, so it was anticipated that no clinical differences would be found. Finally, a clinically relevant increase in quality of life was seen [29], both in patients with BC and in the rest of the participants. Summarizing all the information, our results indicate that rowing is a beneficial activity for individuals with BC. Nonetheless, to recommend rowing in clinical practice, the findings need to be corroborated.

Conclusion

Felucca rowing was able to provide benefits to the physical health and quality of life of the women who participated, both those who had or had overcome BC and those who were healthy. This is a novel study as no studies on felucca rowing have been undertaken previously. Further studies should be conducted on exercise interventions using this style of rowing, with controlled study designs and adding values regarding clinical relevance, such as effect sizes and confidence intervals.

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Authors' contributions MRA designed the study and drafted the manuscript; MIT participated in the study design and helped draft the manuscript; AP participated in the study design, performed the statistical analysis, and helped draft the manuscript; and SH, RN, ALR, and VFG participated in the study design and reviewed critically the manuscript. All authors approved the final version of the text to be submitted for publication.

Data availability The data set would be available upon reasonable request and with the approval of the Ethics Committee of the Department of Health of San Juan de Alicante.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethics approval The study was approved by the Ethics Committee of the Department of Health of San Juan de Alicante on January 29, 2019 (code: 19/302).

Consent to participate All study participants read and signed an informed consent form agreeing to their participation prior to the start of the study.

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