

# Impact of different exercise interventions on anxiety and depression in breast cancer patients

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## Abstract

**Introduction.** The aim of the study was to examine the impact of different exercise interventions on anxiety and depression in breast cancer patients through 1-year outpatient rehabilitation.

**Methods.** Overall, 138 breast cancer patients were assessed for eligibility. After excluding 14 women, 124 patients were randomly allocated to water exercise interventions (group A,  $n = 50$ ), Pilates exercise interventions (group B,  $n = 44$ ), and yoga exercise interventions (group C,  $n = 30$ ). Finally, 115 patients completed relevant interventions and were analysed. The participants reported anxiety and depression using the Hospital Anxiety and Depression Scale at baseline and after 6 and 12 months of the interventions.

**Results.** After 12 months, a decrease in anxiety and depression was observed by 5.64 ( $p < 0.001$ ) and 4.09 ( $p < 0.001$ ) points in group A, by 5.75 ( $p < 0.001$ ) and 4.60 ( $p < 0.001$ ) points in group B, and by 4.07 ( $p < 0.001$ ) and 3.14 ( $p < 0.001$ ) points in group C, respectively. Group A showed significantly better results than group C in anxiety (by 1.54 points;  $p < 0.01$ ) and depression (by 1.40 points;  $p < 0.05$ ). Group B obtained significantly better results than group C in anxiety (by 1.61 points;  $p < 0.01$ ) and depression (by 1.81 points;  $p < 0.01$ ).

**Conclusions.** Practising a water exercise program resulted in a better decrease of anxiety and depression levels compared with Pilates and yoga interventions.

**Key words:** anxiety, depression, breast cancer, psychological distress

## Introduction

Breast cancer is the most frequently diagnosed cancer among women worldwide and often leads to mental health disorders and lower quality of life. Numerous reports have highlighted that many breast cancer patients experience cancer-related fear of recurrence, emotional distress, negative mood symptoms, anxiety, post-traumatic stress disorder, depression after completing treatment [1–5]. Breast cancer diagnosis, performed surgical intervention and adjuvant treatment, changed body image and hair loss, as well as fear about partner's acceptance result in anxiety disorders and depressive reactions [6, 7].

Therefore, it is important to address anxiety and depression because they can create certain difficulties in performing daily activities and also significantly impair the patients' quality of life.

Physical activity is increasingly recognized as an effective method of reducing emotional distress and improving life quality among patients who survived cancer. A growing body of research indicates the benefits of yoga exercises [8–14], cognitive behavioural therapy [15], mindfulness-based stress reduction [16, 17], physical activity [18], music therapy [19, 20], progressive muscular relaxation [21–22], and mixed aerobic and muscle strengthening exercise [23] for improving mental and physical conditions in breast cancer patients.

Research data suggest that yoga exercises are effective tools for relieving fatigue and arm pain, and improving sleep disturbances and fitness outcomes in cancer patients [10, 11, 14, 24], but the problem of the effect of yoga on reducing anxiety and depression in breast cancer survivors is still not fully resolved. A study by Cramer et al. [13] indicates evidence for yoga as a supportive intervention for reducing fatigue and sleep disturbances and improving life quality. Moreover, the authors emphasize that yoga can be as effective as other exercise interventions, which, however, requires further investigation. A randomized controlled trial performed by Taso et al. [25] showed that an 8-week yoga intervention was effective only for reducing fatigue, not for depression or anxiety in breast cancer patients.

The relevance of this study is underlined by the lack of data regarding Pilates and water exercises, whose role in reducing anxiety and depression in breast cancer survivors has not been sufficiently investigated. Despite the available publications, there are no studies in the literature that would identify the most effective program for reducing anxiety and depression in breast cancer survivors.

Consequently, the issue of comparing different interventions and identifying the most effective one in outpatient rehabilitation for breast cancer patients becomes relevant.

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## Subjects and methods

### Participants

Comprehensive sociodemographic characteristics of the analysed patients are shown in Table 1. There were no baseline differences between the studied groups.

A CONSORT flow diagram of the study is presented in Figure 1. A total of 138 breast cancer patients were assessed for eligibility. After excluding 14 women owing to stage 3 of cancer, chronic obstructive lung disease, metastases, ischaemic heart disease, or refusal to participate, 124 patients were randomly allocated to water exercise intervention (group A,  $n = 50$ ), Pilates exercise intervention (group B,  $n = 44$ ), and

Table 1. Sociodemographic and treatment-related characteristics of the analysed participants

Characteristics		Groups		
		A ( $n = 45$ )	B ( $n = 40$ )	C ( $n = 30$ )
Age ( $M \pm SD$ )		58.84 $\pm$ 1.36	59.40 $\pm$ 1.24	59.10 $\pm$ 1.37
Race	White, $n$ (%)	44 (98%)	38 (95%)	29 (97%)
	Black, $n$ (%)	1 (2%)	2 (5%)	1 (3%)
Married/committed relationship, $n$ (%)		42 (94%)	36 (90%)	28 (93%)
High school graduates, $n$ (%)		21 (47%)	20 (50%)	16 (53%)
College graduates, $n$ (%)		20 (44%)	18 (45%)	13 (43%)
High school graduates, $n$ (%)		4 (9%)	2 (5%)	1 (3%)
Body mass index ( $\text{kg}/\text{m}^2$ ) ( $M \pm SD$ )		24.12 $\pm$ 0.42	24.20 $\pm$ 0.44	24.11 $\pm$ 0.38
Treatment	Radiotherapy, $n$ (%)	42 (94%)	38 (95%)	27 (90%)
	Chemotherapy, $n$ (%)	3 (6%)	2 (5%)	3 (10%)
Mastectomy by Madden, $n$ (%)		45 (100%)	40 (100%)	30 (100%)
Time since treatment completion (months) ( $M \pm SD$ )		5.12 $\pm$ 2.54	5.13 $\pm$ 2.79	5.13 $\pm$ 2.87
Cancer stage	Stage 1, $n$ (%)	15 (33%)	14 (35%)	9 (30%)
	Stage 2, $n$ (%)	30 (67%)	26 (65%)	21 (70%)

$M$  – mean,  $SD$  – standard deviation

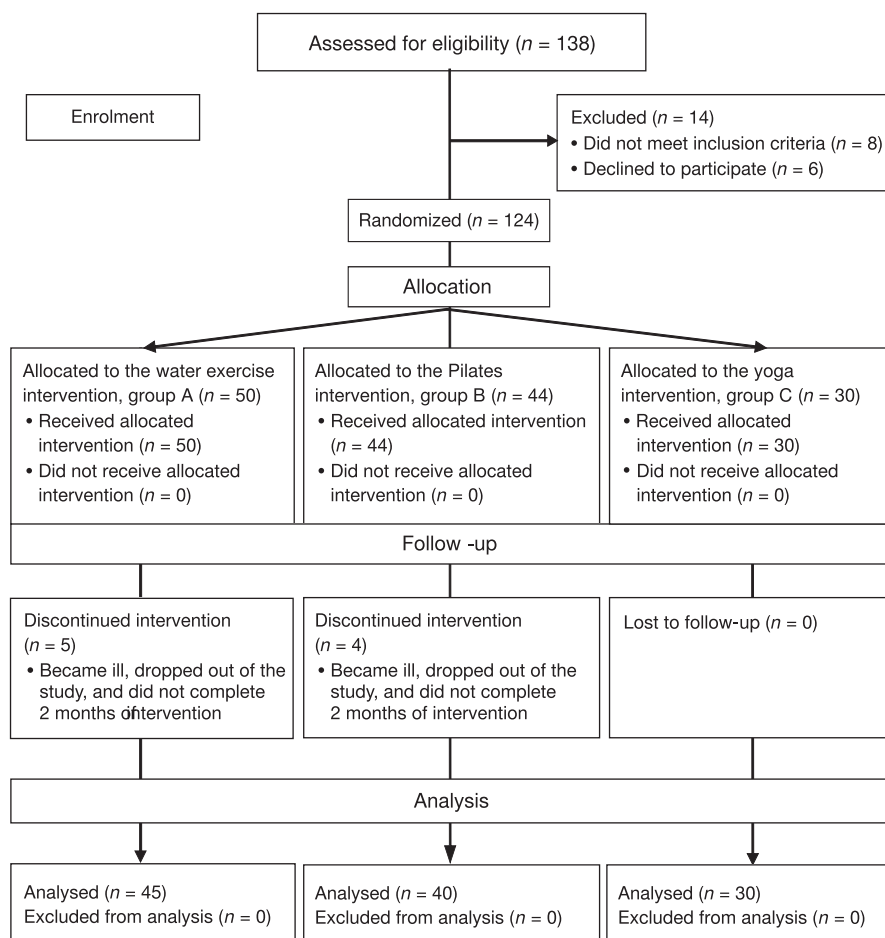


Figure 1. A CONSORT flow diagram of the study

yoga exercise intervention (group C,  $n = 30$ ). Finally, after dropping out, 115 patients completed relevant interventions and were analysed. The participants reported anxiety and depression using the Hospital Anxiety and Depression Scale at baseline and after 6 and 12 months of the interventions. The focus on women aged 50–60 years was applied because the incidence of breast cancer is the highest in this age category.

### Interventions

The components of the 3 interventions were based on the patients' individual baseline functional status of the cardiovascular system, which was classified as average, lower than average, or low level. The groups were engaged in the proposed interventions 3 times a week for 1 hour through 1 year of outpatient rehabilitation. The groups had the same time limit and were conducted by the same physiotherapist.

Water exercise intervention for women of group A was built on a rational combination of swimming, breathing exercises (static, dynamic), combined developing exercises, and exercises of local impact on different muscle groups using various initial positions: standing, half-squatting, sitting, lying on noodles. Noodles, blades, and water dumbbells were applied to increase the load. The intensity of physical activity depended on the motion status and varied from 45% to 70% of heart rate reserve.

Group B received Pilates exercises 3 times per week for 12 months. The aggregated time of Pilates also depended on the functional status of the cardiovascular system and lasted from 40–45 minutes at the adaptation rehabilitation stage to 1 hour at the training stage. The intensity varied from 40–45% to 60–70% of heart rate reserve. All exercises were performed with musical accompaniment and clearly showed by the physiotherapist.

The most important part of a Pilates session for women was Pilates matwork at the adaptation and training stages. It was necessary for the acquisition of initial Pilates skills and principles by breast cancer patients and also for successful task solution. Flexibility and resistance exercises were directed at the muscles of the scapular waist, lower limbs, back, and abdomen.

Group C attended 3 yoga exercise sessions per week for 12 months. The proposed yoga exercise program for breast cancer patients also differed depending on the duration and intensity of the session, the number of exercise repetitions, as well as their percentage. The training of yoga physical exercises began with the study of the asanas technique and breathing exercises; after successful assimilation, the static and motor activity gradually proceeded to the implementation of integral dynamic asanas complexes, which were performed without a pause of rest. The breathing exercises were performed with an emphasis on long exhalation and were well coordinated with movements. The duration of asana retention, its complexity, and the number of repetitions depended on the level of the functional status of the woman and gradually increased as the patient's body adapted to the load. The intensity of yoga exercise varied from low to moderate. The participants constantly concentrated on their own feelings while doing the exercises. For successful training in respiratory exercises, mainly stable sedentary poses were used that allowed to maintain a comfortable position for a long time and contributed to the greatest concentration of attention on the involved muscles in the act of breathing.

### Measurement

Hospital Anxiety and Depression Scale [26] was used to identify the presence and severity of anxiety and depression. This reliable and informative questionnaire consists of 14 questions divided into 2 subscales (7 for anxiety, 7 for depression). The results of self-analysis were classified as follows: 0–7 points: no reliably expressed symptoms of anxiety or depression, 8–10 points: subclinical anxiety/depression, 11 points or more: clinically expressed anxiety/depression.

### Statistical analysis

The data recorded (mean and standard error of the mean) were analysed by using the Statistica for Windows software (version 8.00). Before the concluding analysis, data were evaluated for normality assumption, homogeneity, and occurrence of extreme scores. The distribution of the recorded data was tested with the Shapiro-Wilk test. Such analysis was performed as a preliminary measure before parametric calculations of the analysis of difference. The dependent *t*-test was applied to analyse anxiety and depression parameters in each group between baseline and post-intervention. The independent sample *t*-tests served to compare post-intervention results and identify the most effective interventions.

### Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the review board of the Khortytsia National Academy.

### Informed consent

Informed consent has been obtained from all individuals included in this study.

### Results

Changes in the Hospital Anxiety and Depression Scale parameters in breast cancer patients through 1 year of outpatient rehabilitation are shown in Table 2.

Table 2. Hospital Anxiety and Depression Scale parameters in breast cancer patients through 1 year of outpatient rehabilitation

Indicator	Hospital Anxiety and Depression Scale points ( $M \pm m$ )		
	At baseline	Post-intervention	
		6 months	12 months
Group A ( $n = 45$ )			
Anxiety	11.06 ± 0.47	7.77 ± 0.40*	5.42 ± 0.39*
Depression	8.55 ± 0.44	6.17 ± 0.38*	4.46 ± 0.35*
Group B ( $n = 40$ )			
Anxiety	11.10 ± 0.39	7.62 ± 0.40*	5.35 ± 0.39*
Depression	8.65 ± 0.37	5.65 ± 0.41*	4.05 ± 0.39*
Group C ( $n = 30$ )			
Anxiety	11.03 ± 0.50	8.10 ± 0.47*	6.96 ± 0.42*
Depression	9.00 ± 0.64	6.56 ± 0.52*	5.86 ± 0.46*

*M* – mean, *m* – error of mean

\*  $p < 0.001$  compared with the baseline data

Table 3. Comparison of Hospital Anxiety and Depression Scale parameters among the studied groups after 6 months of outpatient rehabilitation

Indicator	Hospital Anxiety and Depression Scale points ( $M \pm m$ ) after 6 months			$p_1$	$p_2$	$p_3$
	Group A	Group B	Group C			
Anxiety	7.77 ± 0.40	7.62 ± 0.40	8.10 ± 0.47	> 0.05	> 0.05	> 0.05
Depression	6.17 ± 0.38	5.65 ± 0.41	6.56 ± 0.52	> 0.05	> 0.05	> 0.05

$M$  – mean,  $m$  – error of mean,  $p_1$  – comparison between groups A and B,  $p_2$  – comparison between groups A and C,  $p_3$  – comparison between groups B and C

Table 4. Comparison of Hospital Anxiety and Depression Scale parameters among the studied groups after 1 year of outpatient rehabilitation

Indicator	Hospital Anxiety and Depression Scale points ( $M \pm m$ ) after 12 months			$p_1$	$p_2$	$p_3$
	Group A	Group B	Group C			
Anxiety	5.42 ± 0.39	5.35 ± 0.39	6.96 ± 0.42	> 0.05	< 0.01	< 0.01
Depression	4.46 ± 0.35	4.05 ± 0.39	5.86 ± 0.46	> 0.05	< 0.05	< 0.01

$M$  – mean,  $m$  – error of mean,  $p_1$  – comparison between groups A and B,  $p_2$  – comparison between groups A and C,  $p_3$  – comparison between groups B and C

On the basis of the results of a 6-month monitoring, it was established that different exercise interventions contributed to a significant improvement in the emotional state of the breast cancer patients.

There was a decrease in the indicators of anxiety and depression by 3.29 ( $p < 0.001$ ) and 2.38 ( $p < 0.001$ ) points in the first half of the year, and by 5.64 ( $p < 0.001$ ) and 4.09 ( $p < 0.001$ ) points after 1 year, respectively, in group A. A similar situation was observed for Pilates and yoga interventions during 1 year of outpatient rehabilitation.

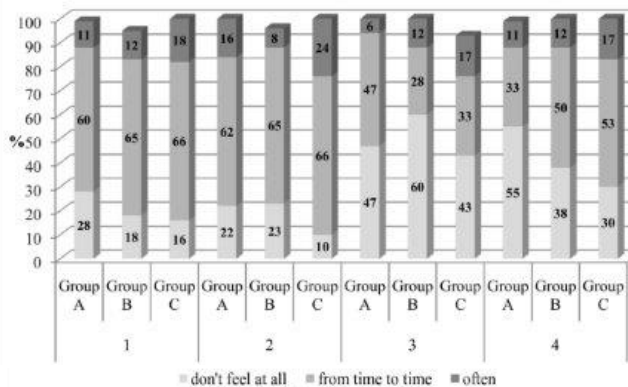
After 6 months, there was a decrease in the anxiety and depression level by 3.48 ( $p < 0.001$ ) and 3.00 ( $p < 0.001$ ) points in the group performing Pilates, and by 2.93 ( $p < 0.001$ ) and 2.44 ( $p < 0.001$ ) points, respectively, in the group performing yoga.

After 12 months, a decrease was found in the anxiety and depression level by 5.75 ( $p < 0.001$ ) and 4.60 ( $p < 0.001$ ) points in group B, and by 4.07 ( $p < 0.001$ ) and 3.14 ( $p < 0.001$ ) points, respectively, in group C.

A comparison of the results obtained after 6 months between the groups revealed that there were no statistically significant differences (Table 3).

When comparing the results of the assessment of anxiety and depression between groups A and B after a year, no statistically significant differences were observed, but a comparison with group C revealed such differences. On the basis of the results after 12 months (Table 4), women of group A showed significantly better outcomes than those in group C: by 1.54 points ( $p < 0.01$ ) for anxiety and by 1.40 points ( $p < 0.05$ ) for depression. After 12 months of Pilates training, women of group B had significantly better results compared with group C: by 1.61 points ( $p < 0.01$ ) for anxiety and by 1.81 points ( $p < 0.01$ ) for depression. In general, the beneficial effect of water exercises on the anxiety and depression level was established compared with Pilates and yoga interventions.

A detailed analysis of the Hospital Anxiety and Depression Scale parameters after a year of outpatient rehabilitation showed that 85% of women in group A, 87% in group B, and 75% in group C did not present anxiety at all. Sub-clinical manifestations of anxiety were observed in 15% patients of group A, 13% of group B, and 20% of group C. Clinical manifestations of anxiety were recorded in 5% of



1 – I feel stress, 2 – Worrying thoughts go through my mind, 3 – I feel tense, 4 – I get sudden feelings of panic

Figure 2. The patients' responses regarding anxiety after a year of intervention

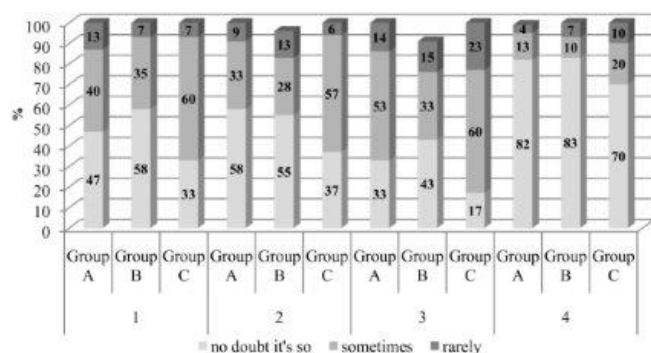
patients in group C. Details for the women's responses regarding anxiety after a year of outpatient rehabilitation are presented in Figure 2.

A detailed analysis of the responses to the statement 'I feel stress' indicated stress occurrence from time to time in 60% of group A, while in group B and C it was recorded in 65% and 66% of patients, respectively.

The analysis of the responses to the statement 'Worrying thoughts go through my mind' showed that only 16% of women in group A, 8% in group B, and 24% in group C often experienced this feeling; worrying thoughts appeared from time to time in 62%, 65%, and 66% of the respective groups. Only 11% of respondents in group A, 12% in group B, and 17% in group C totally agreed with the statement 'I get sudden feelings of panic'; panic was experienced from time to time by 33%, 35%, and 53% of women, respectively.

A detailed analysis of women's responses regarding depression after a year of outpatient rehabilitation is presented in Figure 3. The responses to the statement 'I still enjoy the things I used to enjoy' showed that 47% of women in group A, 58% in group B, and 33% in group C totally agreed with this statement; the feeling was sometimes present in 40%, 35%, and 60%, rarely in 13%, 7%, and 7% of respondents, respectively. The results of the participants' responses revealed that





1 – I still enjoy the things I used to enjoy, 2 – I can laugh and see the funny side of things, 3 – I feel cheerful, 4 – I can enjoy a good book, radio or TV program

Figure 3. The patients' responses regarding depression after a year of intervention

58% of women in group A, 55% in group B, and 37% in group C could laugh and see the funny side of things. Overall, 82% of women in group A, 83% in group B, and 70% in group C were satisfied with a good book or a radio or TV program; 13%, 10%, and 20%, respectively, partially agreed with this statement.

## Discussion

The results from the current study convincingly demonstrate that applying different interventions throughout a year of outpatient rehabilitation significantly improved the emotional state of breast cancer patients.

The assessment of the Hospital Anxiety and Depression Scale parameters after a year of outpatient rehabilitation revealed that water exercise intervention was a more valuable and favourable tool for reducing the anxiety and depression level than Pilates or yoga interventions in breast cancer women.

The results agree with recent studies in that breast cancer patients have negative mood symptoms, anxiety, and depression after cancer treatment [5, 8, 13, 17, 27], and systematic physical exercises are considered as effective tools for enhancing the emotional state and life quality of the women [18, 24].

Previous studies [5, 8, 11, 25] have primarily focused on the effects of yoga on reducing fatigue, depression, and stress in breast cancer patients, but different procedures, duration, and intensity of intervention produce some obstacles in comparing the previous results with the context of the present research.

A study by Włoch et al. [23] evidenced that muscle strengthening interventions performed during 12–13 weeks, twice a week, contributed to reducing markers of depression and cognitive function.

In the current study, the actual level of the breast cancer patients' cardiovascular system functional status was taken into account in the proposed different interventions. The general structure and content of the interventions for patients varied in the duration of the asanas, intensity, and number of repetitions. The combination of various special exercises, breathing exercises, calisthenic routine, and relaxation modes had a great impact on anxiety and depression in the breast cancer patients.

The findings obtained in the current study indicate benefits of water exercises for reducing stress and negative mood symptoms in breast cancer patients.

## Limitations

The limitation of our study was that the anxiety and depression level was measured with a self-reported questionnaire, and differences in the emotional condition of women could have an impact on the obtained results. Further studies are needed to investigate the effectiveness of different interventions on anxiety and depression in heterogeneous populations.

## Conclusions

Practising a water exercise program resulted in a better decrease of the anxiety and depression level compared with Pilates and yoga interventions.

## Disclosure statement

No author has any financial interest or received any financial benefit from this research.

## Conflict of interest

The authors state no conflict of interest.

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