

ORIGINAL ARTICLE

Effects of exercise and oedema massage on fatigue level and quality of life of female breast cancer patients

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Abstract

Aim: To investigate the effect of exercise and oedema massage on the quality of life (QoL) and level of fatigue (LOF) of female patients with stage II and III breast cancer. **Method:** Twenty-seven female patients with stage II and III breast cancer whose ages ranged from 33 to 80 years participated in this study. Participants were randomized into two groups A and B. Participants in groups A received therapeutic exercises and massage, while those in group B received only therapeutic exercises. QoL and LOF were assessed before and 6 weeks after intervention, using a European Organization for Research and Treatment of Cancer quality of life questionnaire (EORTC QLQ-C30) and Energy/Fatigue Scale, respectively. **Result:** There was a significant improvement ($p < 0.05$) between the pre- and post-intervention QoL scores of participants in study group A, and between the post-intervention QoL scores of participants in study group A and control group B ($p < 0.05$). There was also a significant improvement ($p < 0.05$) in the LOF between the pre- and post-intervention scores for participants in groups A and B, respectively, and between the post-intervention scores of the participants in the groups A and B ($p > 0.05$). **Conclusion:** Combined exercise and massage improved the QoL and LOF of female patients with stage II and III breast cancer compared with exercise alone.

Key words: Breast cancer, exercise, fatigue, massage, QoL

Introduction

Cancer is a pathological breakdown in the processes that control cell proliferation, differentiation and death of particular cells; it can affect any part of the body (1). Breast cancer is the third most common cancer worldwide (after skin and lung cancers), accounting for 10.4% of all cancer (1,2). Breast cancer, which occurs most commonly in women, is the most frequently diagnosed cancer among women worldwide, after skin cancer, representing 16% of all female cancers (2). It is the fifth most common cause of cancer death among women worldwide, after cancer of the lung, stomach, liver and colon, causing about 13% of all deaths (1,2). Breast cancer has been reported as the most common malignancy affecting women in Nigeria (3).

In 95% of all cases of breast cancer, the definite cause(s) of the cancer is unknown, although excess production of free radicals in the body has been implicated (4,5). Also, certain risk factors have been linked to breast cancer, some of which include increasing age, previous breast cancer, family history of breast cancer, breast cancer genes, fibroblastic breast disease, age at puberty, age of first pregnancy, age of menopause, childbearing, breast feeding, prolonged oral contraceptive, exposure to radiation, tobacco and alcohol consumption, and engagement in physical activities (6). The usual first line of management of breast cancer is surgery to remove the tumour. There are adjuncts to surgery and these include the use of chemotherapy, radiation therapy, hormone therapy, physiotherapy, and targeted or biological therapy.

The number of women who survive breast cancer is increasing due to early detection of the disease and improvement in medical care; however, survivors often encounter physiological and psychological problems related to their diagnosis and treatment and this influences long-term prognosis (7). Gain in body weight and psychosocial distress are two commonly encountered adverse responses to breast cancer diagnosis and treatment that can have a negative impact on quality of life (QoL) and survival of women with breast cancer (8,9). Other complications associated with breast cancer that have a negative impact on QoL of breast cancer patients include decreased shoulder mobility, loss of arm strength, weight gain, sleep disturbances, cancer-related fatigue, aches or pain, poor body image, increased risk of osteoporosis, cardiovascular disease, premature menopause, loss of libido and lymphoedema and emotional distress – including depression and anxiety (10–12).

Cancer care is being directed toward developing interventions to improve overall QoL as well as longevity (13,14). QoL refers to individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns (15). It also includes mental and physical health, material well-being, interpersonal relationships within and outside the family, work and other activities in the community, personal development, fulfilment and active recreation (16). Cancer-related fatigue is common among cancer patients (17). It can occur during treatment or after treatment is completed, and has been reported to affect 70% to 100% of cancer patients (18). Cancer-related fatigue has been reported to result in restrictions in activity and participation in life events (17). Therapeutic exercises and/or increased activity have been recommended as one of the non-pharmacological approaches in the management of cancer-related fatigue (19,20).

Therapeutic exercise has consistently been identified as a central element of rehabilitation for many chronic diseases and has been successful in improving QoL and reducing all-cause mortality (19,20). Aerobic exercises help improve muscle pump action and controls body mass index in addition to improving QoL (21). A recent observational study has suggested that moderate levels of physical activity may reduce the risk of death from breast cancer (8). Regular exercise has been suggested to offer some modest protection against a number of cancer complications, by reducing heart rate, decreasing risk of cardiovascular diseases, reduction of bone loss and body fat (8). Physical exercise also improves physical functional ability and decrease fatigue and

osteoporosis that may be associated with cancer treatments (8). Pumping exercises are used to move fluid through the lymphatic channels, and also to maintain mobility of the affected limbs (22). The affected upper extremities are usually held in an elevated position during the exercises, and soft tissue manipulation (oedema massage) is usually interspersed throughout the exercise sequence to enhance lymphatic drainage further (22). This study sought to determine the effect of combined aerobic exercise and oedema massage on fatigue level and QoL in female patients with breast cancer.

Materials and method

Participants

Prior to the commencement of the study, ethical approval was sought and obtained from the Health Research and Ethic Committee of LUTH (ADM/DCST/221/Vol. II). A total of 27 female patients with stage II and III breast cancer, with arm swelling (lymphoedema) participated in the study. They were recruited from the outpatient unit of the Radiotherapy and Oncology Department of the Lagos University Teaching Hospital (LUTH), Idi-Araba, Lagos. Their ages ranged from 33 to 80 years. Patients with orthopaedic and neurologic conditions, surgical conditions such as incomplete axillary surgery, trans-abdominal rectus abdominis muscle reconstruction surgery, and uncontrolled illness that may hinder exercise performance were excluded from participating in the study. Participants were recruited into the study after mastectomy and radiotherapy, and they were still on chemotherapy. All the participants have lymphoedema, i.e. arm swelling. Only those who consented were allowed to participate in the study.

Treatment assignment

Excel 2007 (Microsoft) was used to generate a list of randomized number sequence, which was used to assign eligible participants randomly into two groups (study and control groups) as they became available (23).

Evaluation of participants

The study was conducted at the medical gymnasium of physiotherapy department of LUTH. Socio-demographic information including age, marital status, sex, occupation, education status and living arrangements was obtained from the participants. Thereafter, participants' height (metres) and weight

(kilograms) were measured and recorded using a height meter (Schihz, Germany) and bathroom weighing scales (Hana, Taiwan). Blood pressure was also measured using a mercury in-glass sphygmomanometer (Littman, USA) and a stethoscope (Bart, USA).

The QoL and the level of fatigue (LOF) of the participants in the two groups were assessed before and 6 weeks after the intervention using the European Organization for Research and Treatment of Cancer's Quality of Life questionnaire (EORTC QLQ-C30) and Energy/Fatigue Scale, respectively. Participants were asked to read through the QoL questionnaire carefully and indicate the items that best described their situation. The EORTC QLQ-C30 questionnaire was a self-evaluation test questionnaire with a 33 open-ended questions, which is divided into four sections. Their scores on the QoL questionnaire were expressed over a total sum obtainable of 126. The EORTC QLQ-C30 (version 3) questionnaire is an instrument for assessing health-related QoL in cancer patients, and was designed in 1993 by the European Organization for Research and Treatment of Cancer to assess health-related QoL of cancer patients (24,25). It has been found to be a reliable ($r = 0.67$) instrument (25). A lower score on the EORTC QLQ-C30 (version 3) questionnaire indicates an improvement in QoL.

Also, participants were asked to rate their LOF on the Energy/Fatigue Scale (EFS), which is a verbal rating scale of fatigue intensity (26). It was derived from the Rand Vitality Index and consists of five questions ("I feel full of energy"; "I feel tired, worn-out or exhausted"; "I wake up feeling fresh and rested" – the responses to this item were then reversed; "fatigue has interfered with my work, family or social life" and "Fatigue has been one of my three most disabling symptoms") with a five-choice response format (0 = none of the time, 1 = a little of the time, 2 = some of the time, 3 = a good bit of the time, 4 = most of the time and all of the time). It contains adjectives describing both fatigue (worn out, tired) and energy (pep, energy). The scores were then summed (total sum obtainable = 25) and a higher score indicates improvement in the severity of fatigue-related symptomatology. It has been reported to show good internal consistency (26).

Treatment protocol

Participants in study group A were taken through the exercise protocol that consisted of 6-min warm-up period, which included body movement exercises such as slow walking with free breathing. The warm-up period was followed by the main exercise protocol, which lasted 30 min. This was followed by

4-min cool-down period, which involved deep breathing (participants were instructed to breath in as deeply as possible and then breath out slowly through the mouth) and an ankle pump exercise (dorsiflexion and plantarflexion). The main exercise protocol comprised of stretching and aerobic exercises that have been reported as helpful in improving QoL and LOF in female patients with breast cancer (13,20,27,28).

The participants carried out gentle stretching exercises to the upper extremities. These included: (i) active circumduction of the arm in supine position – the arm to be moved was flexed at 90° and the participants instructed to reach toward the ceiling and do active circular movements of the arm in a clockwise manner and then in an anticlockwise manner; (ii) bilateral hand press in sitting position – the participant's arms was elevated to shoulder level and elbow flexed, and the palms of the hands were then placed and pressed together in front of the head and chest while breathing, for a count of five and then relax; (iii) bilateral horizontal abduction and adduction of the upper extremities in sitting or standing position – both hands were placed behind the head, the shoulders were then horizontally adducted (moved together) and abducted (move away) by bringing the elbows together and back to the starting point; (iv) overhead wall press in standing position – the participant faced the wall, placed one or both arms on the wall with the hands above the shoulder level, the palm was then gently pressed against the wall for 7 s without moving the body and then relaxed; (v) reciprocal pulley exercise to the upper extremities – with the participants holding each hand of pulley, the unaffected hand was used to pull the rope and lifts the involved extremity in an upward motion. This was repeated 20 times and progressed accordingly. Each procedure was repeated five to seven times.

The aerobic exercise was done with the use of bicycle ergometer for 3 min per exercise session. The seat of the bicycle ergometer was adjusted such that there was slight flexion (15°) at the knee joints of the legs on the pedal. A Metronome was used to set the rate of pedalling at 50 revolution per minute (rpm). The initial resistance to cycling was set at 25 W and was then progressively increased by 25 W at the end of every minute. For the participants in group A, the exercise protocol was performed twice a week for 6 weeks.

The exercise protocol for participants in the study group (group A) was concluded with 15-min oedema massages (soft tissue manipulation technique) comprising of slow, deep effleurage, kneading and frictional massage, on the affected upper limb (i.e. the swollen arm) while being held at a 45° elevation in a lying or sitting position so that gravity can assist

the lymphatic drainage. The composition of the oedema massage is similar (in approach) to the popular modes of Dr Vodder's Manual Lymph Drainage Technique (MLDT). It was performed by a trained research assistant, different from the person who coordinated the exercise protocol. The efficacy of MLDT has been documented in the literature (29,30,31). Improvement in hand swelling was assessed by measuring the circumference of the upper limb (limb girth) before and after intervention, using a point 13 cm from the olecranon process. After the exercise protocol, participants in group A were given a paper containing some exercises (Figure 1) and instructed to practice the exercises contained in the paper at home, at least twice daily for the 6-week duration of the study. The entire exercise period lasted for 40 min; however, this period reduced as the condition (pain/fatigue) affected the patients. Reduction in the exercise duration was also used as a measure of improvement in the participants.

The participants in the control group (group B) only went through the exercise protocol. Thus the

exercise protocol for participants in this group did not end with a 15-min oedema massage. They were also taught the exercises contained in Figure 1, and were given a paper containing these exercises so that they could practice at home. They were instructed to carry out these exercises at home at least twice daily for 6 weeks.

The exercise protocol for participants in the two groups were supervised by one of the researchers, and there was a weekly telephone call follow-up for all the participants in groups A and B, to encourage them with their "home programme".

Data analysis

The data collected were analysed using the SPSS version 17 (SPSS Inc., Chicago, IL, USA), and summarized using descriptive statistics of mean and standard deviation. A paired *t*-test was used to determine significant difference within the groups, while independent (unpaired) *t*-test was used to determine

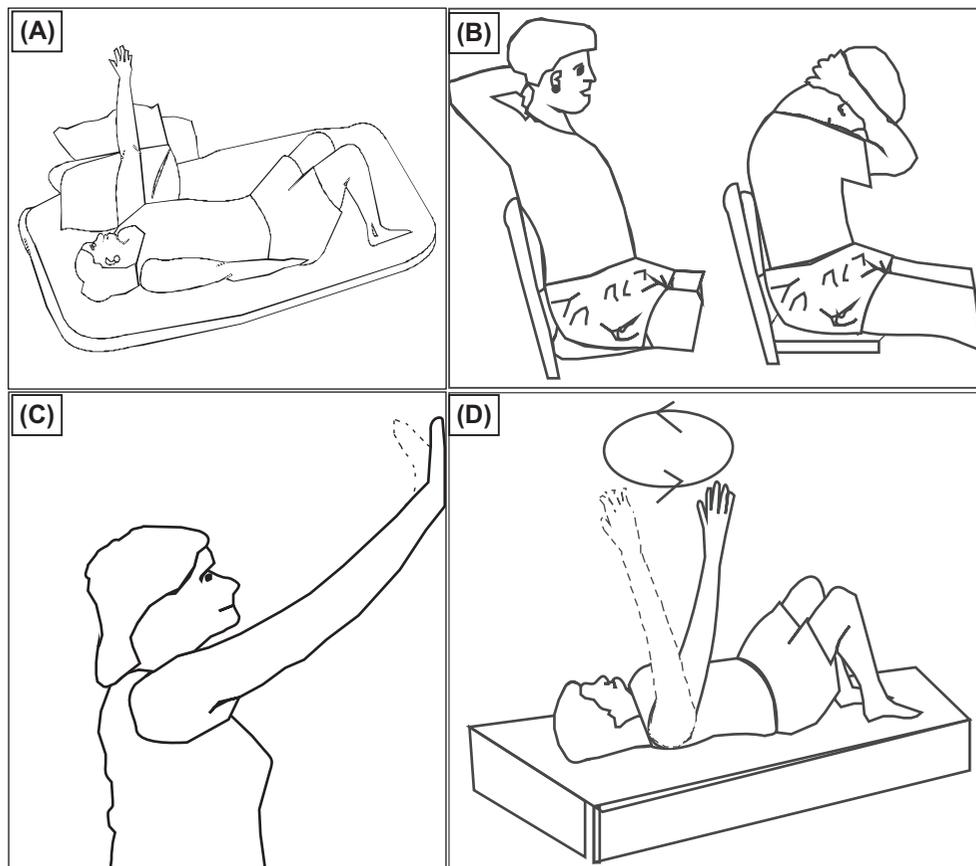


Figure 1. Illustration of the home programme exercises: (A) arm elevation to 45° on pillows while lying face up and relaxed; (B) bilateral horizontal abduction and adduction of the upper extremity, with the unaffected hand holding the affected hand behind the head; (C) overhead wall press, with one or both hands placed on the wall above the shoulders and the palm(s) gently pressed against the wall; (D) active circumduction of the affected arm in both clockwise and anti-clockwise directions. Each exercise is done to a count of 5, then the patient relaxes, and the exercise is repeated three times. They were instructed to improve on this count whenever possible.

Table I. Age and physical characteristics of the participants in the study and control groups.

	Study group Mean \pm SD	Control group Mean \pm SD	<i>t</i>	<i>p</i> -value
Age (years)	46.00 \pm 8.40	54.00 \pm 14.00	2.04	0.05
Height (m)	1.59 \pm 0.10	1.61 \pm 0.10	0.56	0.58
Weight (kg)	73.40 \pm 9.00	69.10 \pm 9.30	1.18	0.24
Body mass index (kg/m ²)	29.00 \pm 3.20	26.70 \pm 3.90	1.63	0.12
Systolic blood pressure	116.00 \pm 8.50	121.50 \pm 7.40	1.42	0.17
Diastolic blood pressure	71.80 \pm 7.90	74.60 \pm 7.90	0.92	0.16

Duration of cancer diagnosis (years): 2–4.

significant difference between the groups. The statistical test of significance was kept at $p < 0.05$.

Results

The total number of female breast cancer patients selected was 40. Out of these, three declined to participate in the study. Ten participants could not complete the treatment protocol and so were excluded for variety of reasons: death (3 = group A, 4 = group B), distance constraint (1 = group B), while 2 breast cancer patient from group B stopped coming for no given reason. Thus a total of 27 female patients with stage II and III breast cancer (study group = 17; control group = 10) were included in the study and evaluated.

Table I showed the physical characteristics of the participants; there was no significant difference ($p > 0.05$) between the two groups pre-intervention. The mean values of the QoL scores pre-intervention were 84.17 ± 22.10 and 91.10 ± 13.70 for the study group and the control group, respectively; there was also no significant difference ($p > 0.05$) in the QoL scores between the two groups pre-intervention (Table II). However, there was a significant improvement ($p < 0.05$) in the QoL of participants in group A compared with those in group B, 6-week post-intervention (Table II). The unpaired *t*-test also showed that there was a significant improvement ($p < 0.05$) in the post-intervention scores of QoL of the participants in both groups compared with the pre-intervention scores (Table II).

The mean score of the LOF pre-intervention were 9.10 ± 5.00 in the study group and 5.70 ± 1.00 in the control group; there was no significant difference ($p > 0.05$) in the LOF between the two groups at baseline (Table III). There was, however, a significant difference ($p < 0.05$) in the mean score of the LOF between the two groups at 6 weeks post-intervention (Table III). Also, the unpaired *t*-test showed that there was a significant difference ($p < 0.05$) between pre- and post-intervention mean score of the LOF for participants in the study group as well as control group (Table III).

There was a significant difference ($p < 0.05$) between the mean upper limb girth measurement for participants in the study and control groups; also the mean change of the upper limb girth measurement for the participants in the study group was significantly ($t = 4.135$, p -value = 0.001) higher than those of the participants in the control group (Table IV).

Discussion

This study was an attempt to explore the efficacy of physiotherapy *vis-à-vis* therapeutic exercise and oedema massage (soft tissue manipulation) in the management of female patients with stage II and III breast cancer. The finding that there was no significant difference between the physical characteristics of the participants in the two groups at baseline suggests that the two groups were homogenous at baseline. It was hypothesized that there would be no significant difference in the QoL scores and LOF

Table II. Pre- and post-intervention analysis of quality of life (QoL) between the participants in the study and control groups.

	Study group Mean \pm SD	Control group Mean \pm SD	<i>t</i>	<i>p</i> -value
Pre-treatment	84.17 \pm 22.00	91.10 \pm 13.70	0.89	0.38
Post-treatment	49.41 \pm 9.90	79.50 \pm 12.30	6.95	< 0.001*
<i>t</i> -value	5.94	1.98		
<i>p</i> -value	< 0.001*	0.06		
Percentage change (%)	70.40	14.60		

*Significance at $p < 0.05$.

Table III. Pre- and post-intervention analysis of the levels of fatigue (LOF) between the participants in the study and control groups.

	Study group Mean \pm SD	Control group Mean \pm SD	<i>t</i>	<i>p</i> -value
Pre-treatment	9.10 \pm 5.00	5.70 \pm 1.00	2.11	0.05
Post-treatment	16.70 \pm 3.20	6.80 \pm 1.60	9.10	< 0.001*
<i>t</i> -value	0.28	2.41		
<i>p</i> -value	< 0.001*	0.02*		
Percentage change (%)	45.50	19.30		

*Significance at $p < 0.05$.

between the participants who received therapeutic exercise and massage (study group) and those who received therapeutic exercise only (control group).

Statistical analysis showed that there was no significant difference in the pre-intervention QoL scores and LOF between the participants in the study group and control group respectively, suggesting that the participants in the two groups were homogenous at baseline. However, 6 weeks after the intervention (treatment), there was a significant improvement between the pre- and post-treatment QoL scores of the participants in the study group (group A). While the improvement observed between the pre- and post-treatment QoL scores of the participants in the control group (group B) was not statistically significant, the unpaired *t*-test also showed that there was a significant improvement in the post-intervention QoL scores between the participants in the study and control groups. These findings suggest that combined therapeutic exercise and oedema massage is capable of improving the QoL of female patients with stage II and III breast cancer than therapeutic exercise only. Also, the finding that the percentage change between the pre- and post-intervention QoL was greater for the study group compared with that of the control group further suggests that combined therapeutic exercise and oedema massage is a better treatment option in improving the QoL of female patients with stage II and III breast cancer. Furthermore, the finding that the mean change in limb length measurement for the participants in the study group was significantly higher than those of the participants in the control group also confirmed that combined exercise therapy and oedema massage is a

superior treatment option for female patients with stage II and III breast cancer. Thus, while increased activity and therapeutic exercise has been widely reported to improve QoL in female patients with breast cancer and also reduce the risk of death from the disease (8,13,20,27–29), the additional effect of oedema massage (i.e. soft tissue massage), which has been demonstrated by the finding of this study, cannot be over emphasized. The finding of this study has showed that combined exercise therapy and oedema massage is a better treatment option compared with exercise therapy alone for female patients with stage II and III breast cancer.

The results of this study also showed that there was a significant difference in the LOF between the participants in the study group (combined therapeutic exercise and oedema massage group) and control group (therapeutic exercise only group) 6 weeks after intervention. This implied that there was a significant improvement in the LOF of the participants who had combined therapeutic exercise and oedema massage when compared with those who were given therapeutic exercises only. The finding that there was a significant improvement in post-intervention mean score value of LOF, compared with pre-intervention mean scores value of LOF for both groups, suggests that the two treatment protocols employed in this study were effective treatment options as non-pharmacological treatment of cancer-related fatigue. This was also evident when upper limb girth measurement was analysed; there was a significant difference between the upper mean limb girth measurement for participants in the study and control groups. These findings suggest that therapeutic

Table IV. Pre- and post-intervention analysis of the mean limb girth measurement (taken 13 cm from the olecranon process) for all participants.

Limb girth	Study group Mean \pm SD	Control group Mean \pm SD	<i>t</i>	<i>p</i> -value
Pre-intervention	40.14 \pm 4.36	39.12 \pm 3.99	0.503	0.625
Post-intervention	37.30 \pm 3.81	37.97 \pm 4.12	-0.346	0.734
<i>t</i> -value	8.849	4.552		
<i>p</i> -value	0.000	0.006		
Mean change (post-pre)	2.84 \pm 1.16	1.15 \pm 0.62	4.135	0.001

exercise only (increased activity) can be safe and capable of improving LOF in female patients with breast cancer. Also, the finding that the percentage change between the pre- and post-intervention LOF was greater for the study group compared with that of the control group further suggests that combined therapeutic exercise and oedema massage is a better treatment option in improving the LOF of female patients with stage II and III breast cancer. This has been widely reported in the literature and it is in agreement with the finding of Courneya et al. (13), Schmitz et al. (19) and Dimeo et al. (32), who in their various studies reported that exercise is beneficial in the management of cancer-related fatigue. Generally, aerobic exercises have been reported to be capable of improving muscle pump action and controls body mass index (21). This may be responsible for the improved QoL observed in this study.

Exercise improves myocardial circulation and metabolism, which in turn protects the heart from hypoxic stress, and also enhances glycolytic capacity (31). This condition improves the heart oxygen supply and its contractility during a specific challenge, thus the heart rate and blood pressure are favourably reduced so that the work of myocardium is significantly reduced at rest and during exercise thereby reducing the LOF. However, the finding that there was a significant improvement in the LOF of the participants who had combined therapeutic exercise and oedema massage, compared with those who had therapeutic exercises only, further suggests that combined therapeutic exercise and oedema massage is a better treatment option for female patients with stage II and III breast cancer.

A high level of emotional distress (including depression and anxiety) has been reported among female patients with breast cancer; this has been shown to have adverse effects on the QoL of individual diagnosed of breast cancer (13,14,20). Also, it has been reported in a descriptive study evaluating QoL among female patients with breast cancer that fatigue, among other factors like aches or pain, sleep disturbances, menstrual and fertility concerns, was one of the major physical changes influencing QoL of female patients with breast cancer (12). It is therefore not impossible that an improvement in LOF may invariably lead to an improvement in QoL. Thus, improving the overall QoL of female patients with breast cancer will promote good health as well as longevity in this category of patients (13,14). There are possible limitations that might have influenced the results of this study – the small sample size that resulted from substantive drop-out rate, and the short exercise duration; furthermore, it has been stated in a recent review study that female patients with breast cancer

are more likely to benefit from an exercise that is approximately 12 weeks long (33). Although, the studies included in this review used a wide varieties of frequency, duration and intensity of exercise (33).

Conclusion

The findings of this study showed that therapeutic exercises combined with oedema massage (a type of manual lymph drainage technique) are effective in increasing the QoL and reducing the LOF of female patients with breast cancer. This study has been able to reveal some of the benefits that can be derived by cancer patients when they engage in therapeutic exercise, thus providing pointers to the substantial role of physiotherapy in the care of female patients with breast cancer, and these effects can be further enhanced when oedema massage is combined with therapeutic exercise. Combined exercise and oedema massage is therefore recommended as a better non-pharmacological therapeutic approach in improving QoL and LOF in female patients with breast cancer. One obvious limitation of this study is the smaller sample size; therefore a further study, using a larger sample, may be needed further to enrich the findings of this study.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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