Yoga for women with breast cancer-related lymphoedema: a preliminary 6-month study

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Background: The lifelong nature of breast cancer-related lymphoedema (BCRL) requires an exploration of activities that may be of potential benefit. Exercise trials in BCRL are becoming more common. **Aims:** To determine if the continued practice of yoga for 6 months imparts measureable benefits in reduction of lymphoedema, self-reported symptoms, and quality of life (QOL). **Methods:** Women who had previously completed a 4-week yoga programme as part of a randomised control trial were invited to return for reassessment 6 months after the intervention ceased. Lymphoedema status was measured using bioimpedance spectroscopy (BIS), perometry, tonometry and lymphoedema symptoms, and QOL were assessed. Follow-up measurements were compared to baseline and those who had continued yoga were compared to those who had not. **Results:** Although there were no statistically significant differences between the groups, trends suggested a benefit in continuing yoga for reduction of lymphoedema affected arm volume by BIS and perometry and skin softening by tonometry. QOL scores has declined more in the discontinued group than among women who continued yoga. **Conclusion:** Yoga is a popular and potentially safe activity for women with BCRL. This study demonstrates trends in improvement of both objective and subjective measures that justify further investigation by future larger, longer-term investigations.

Key words

Breast cancer-related lymphoedema

Yoga

Innovation in the treatment of breast cancer is reducing the level of collateral damage to the lymphatic system, however, injury during surgery, lymph node removal, or radiation therapy is often unavoidable and can lead to lymphoedema of the arm, breast, or trunk (Cormier et al, 2010). Most women do not develop arm lymphoedema, but as many as 89% of breast cancer survivors experience transient symptoms at some time and all may be considered in a latent phase and at risk for the remainder of their lives.

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Breast cancer-related lymphoedema (BCRL) can manifest at any time with cases being recorded from immediately following surgery to decades after all cancer therapies have ceased (Clark et al, 2005; Norman et al, 2009). BCRL is a chronic condition that must be managed for the patient's remaining life span (Petrek et al, 2000) to minimise the negative impact on quality of life, increase the ability to partake in work, family and recreational activities or hobbies, and improve self image (Radina, 2009). Therefore, it is, important to identify beneficial activities that are accessible, inexpensive and can be performed independently of ongoing professional supervision.

'Injury during surgery, lymph node removal, or radiation therapy is often unavoidable and can lead to lymphoedema of the arm, breast, or trunk'

Evidence that all forms of exercise including vigorous activities are beneficial for women recovering from breast cancer and may prevent cancer recurrence (Cadmus et al, 2009) is driving a trend toward recommending that breast cancer survivors exercise to maintain health and prevent disease recurrence. Similarly, supervised progressive exercise programmes have been shown to benefit women with BCRL (Schmitz et al, 2009) and activities involving the arm on the affected side is correlated to a reduced incidence of arm lymphoedema (Hayes et al, 2008). However, little is known about specific activities that may potentially reduce lymphoedema status or risk of onset.

Yoga is a popular practice adopted as a regular activity by 2.9% of Australians with as many as 12% using yoga for specific therapeutic purposes (Penman, 2008). Studies of the use of yoga by breast cancer patients and survivors suggest that yoga may impart both physical and emotional benefits, as well as reducing symptoms and increasing overall quality of life (Bower et al, 2005; Moadel et al, 2007; Rao et al, 2007; 2009, Vadiraja et al, 2009). This increasing popularity has brought yoga practice under scientific scrutiny with a number of studies confirming that yoga practice increases muscle strength, flexibility, and range of movement (Bower et al, 2005, Danhauer et al, 2009).

Research across a broad spectrum of health disciplines reveals the benefits of yoga in symptomatic improvement of a range of chronic conditions (Bower et al, 2005) and as many as 90% of people practicing yoga do so to address mental health issues such as sleep disorders, anxiety, depression, and stress (Penman, 2008). Yoga breathing, relaxation and meditation have proven to be more beneficial in reducing stress and increasing a sense of wellbeing than exercise alone (Ross and Thomas, 2010) and can be practiced even when a person is ill or immobilised (Danhauer et al, 2009).

Women with arm lymphoedema report the need for coping strategies to deal with the mental health and psychosocial impacts of BCRL and some find spiritual or religious activities with the support of others important coping mechanisms (Heppner et al, 2009; Shih et al, 2009). Yoga practices, such as mindful meditation and breathing exercises, foster self-control (Posadzki and Glass, 2010) and mindful meditation is shown to foster a sense of hope in adults (Sears and Kraus, 2009). Yoga has the potential to address physical, emotional and mental needs and can be adapted to suit the abilities of the individual.

The attention to self awareness and mindful exercise employed during yoga practice may enhance a woman's ability to identify symptoms. Such subjective measures are gaining recognition as an early sign of the need for intervention and effective measures of change in lymphoedema status (Armer et al, 2003).

Yoga classes are often easy to access through local community organisations and services, and can be adapted to cater for all stages of ability. This is important as adherence to exercise programmes increases the effectiveness of the intervention (Danhauer et al, 2009; Hayes et al, 2009; Schmitz et al, 2009). Yoga practice encourages long-term adoption of beneficial behaviours, is inexpensive to practice, can be a source of enjoyable social interaction, and can be achieved by a wide spectrum of the population.

Yoga has been used successfully in management programmes for filarial lymphoedema in India where yoga exercises and breathing techniques are integrated into lymphoedema management programmes (Narahari et al, 2008; 2010), however, there have been no previous reports of yoga as an intervention for the management of BCRL.

This study aimed to ascertain if a 4-week intervention introducing a yoga programme to women with BCRL would lead to long-term use of yoga practice, and to determine if regular yoga practice imparts any benefit in terms of lymphoedema status, symptoms, or overall quality of life. The study was approved by the Flinders Clinical Research Ethics Committee (FCREC), Adelaide, Australia.

Method

Thirty-five women who participated in a 4-week, randomised controlled trial (RCT) on the effects of yoga in BCRL were invited to return for reassessment 6 months after the intervention had ceased.

Eighteen women responded and were asked to report on their attendance of yoga classes, or use of any parts of the yoga home programme, in the intervening period. Subjects were allocated to an active group if they had either attended weekly yoga classes or continued the home yoga programme, including ***asanas*** (modified yoga-based physical exercises) a minimum of once per week, or to the control group if they had continued neither. Participants were also asked to report on their intention to practice yoga in the future.

Yoga intervention

All participants had attended a single self-management seminar prior to commencing in the yoga programme. The 90-minute seminar included education about normal lymphatic function, damage occurring to the lymphatic system during breast cancer treatment, and risk factors for the development or exacerbation of lymphoedema. Advice was given on current best practice for self-management, including a discussion of self or partner lymphatic massage, skin care, exercise and appropriate compression therapies. All participants were encouraged to commence and continue appropriate self-care.

The initial yoga intervention was a 4-week programme consisting of weekly yoga class supported by a home programme to perform on the remaining 6 days. The programme was devised by Dr Maarten Immink in consultation with a yoga advisory group consisting of a lymphoedema practitioner and yoga teachers with experience in yoga for women with breast cancer. The trial was given permission to use these practices for research purposes by Satyananda Yoga® Australia.

A progressive, standardised yoga programme aimed at individuals with no previous yoga experience and based on the Satyananda Yoga® tradition was developed in line with exercise guidelines for lymphoedema (Casley-Smith, 1999; Saraswati, 2001; 2008). This included avoiding heavy loading of the affected arm and restricting static postures while emphasising continuous movement and breathing exercises. All yoga practices that would usually be done on the floor were adapted to offer options to be performed either sitting or standing or both. The programme also modelled lymphatic clearance principles by commencing with clearing of the trunk then working distal to proximal in each arm. Examples of trunk and arm movements are illustrated in ***Figure***

***Kati Chakrakasana* – waist rotating pose**

***Manibandha Naman* (wrist bending)**

***Kehuni Naman* (elbow bending)**

***Skandha Chakra* (shoulder rotation)**

Figure 1. The above images illustrate four of the movement series used in this study

1.

The 90-minute weekly group classes involved three main activities: ***asanas***, breathing exercises (***pranayamas***), and meditation. A modified 40-minute home programme consisting of the same three main activities and based on practices learned in classes was supported by an instruction manual describing and illustrating the practices and their alternatives, and a CD audio recording of the relaxation exercise.

The classes were conducted during late winter and early spring and held at a community hall located centrally to the recruitment area. The female instructor was an accredited Satyananda Yoga® teacher with over 20 years' teaching experience.

Data collection

All measurements were performed in the Lymphoedema Assessment Clinic (LAC) at Flinders Medical Centre in a temperature-controlled environment. Baseline characteristics, cancer treatment history, and lymphoedema history were collected at the pre-intervention measuring appointment including presence of relevant comorbidities such as heart disease, hypertension, and diabetes. Information regarding current use of hormone therapies, compression garments, lymphoedema treatment history, and history of any injuries or infections in the affected area were recorded.

Objective measures

The three objective measures of lymphoedema status: bioimpedance spectroscopy (BIS), perometry, and tissue tonometry are all validated and used

previously in trials conducted by the LAC and elsewhere (Moseley et al, 2002; Ridner, 2007). All objective measures were taken at least twice at each assessment point and an average of the two measurements was recorded.

Bioimpedance spectroscopy

The InBody 3.0® system (BioSpace Ltd, USA) multi–frequency body and segmental analyser was used to calculate the extracellular fluid load of the affected arm compared to the unaffected arm and body mass index (BMI).

Perometry

Perometer (Pero-systems®, Germany) software was used to calculate a whole arm volume and arm circumference at 3-mm intervals. Hand volumes using this method are potentially inaccurate and the first 118mm (average hand length) was excluded. Since the construction of the frame also prevents measuring arm volumes to the top of the shoulder, a consistent length measurement for each participant was determined by calculating 80% of the total arm length from the tip of the middle finger to the anterior axillary fold. This measurement was added to the distal end point (118mm) to determine the proximal end point of the measure for each individual. This method of length calculation ensured internal group consistency in measurements, and that affected and unaffected limbs were equalised for length.

Tonometry

A mechanical tissue tonometer (Flinders Medical Centre Biomedical Engineering, Australia) was used to measure tissue resistance to pressure, giving an indication of changes in the dermis and the extent of any fibrotic induration.

Subjective measures

All subjective measures were recorded before objective measures were taken. Self-reported lymphoedema (SRL) symptoms were measured using a 10–point Likert scale (Likert, 1932) where one indicated that the symptom was not present, while 10 was the worst imaginable experience of that symptom. Symptoms of pain, heaviness, tightness, burning sensations, arm temperature changes, perceived size of the arm, and restriction to range of motion were compared with the unaffected arm and rated as they were felt at the time of assessment. This scaling system has been validated elsewhere (McKenzie and Kalda, 2003).

Quality of life

Global quality of life was measured on a visual analogue scale (VAS). The participant was asked to place a vertical mark across a 10cm horizontal line with end points labelled 'poor' and 'excellent'. The distance in millimetres was measured from the left end of the line to the point at which the participant's vertical mark dissected the printed line – a higher value representing a higher perceived quality of life (Grant et al, 1999).

Statistical analysis

All analyses were performed using STATA statistical software, version 12.0 (StataCorp. 2011, USA) and R version 2.14.2 (R Development Core Team, 2011; Austria). Baseline characteristics were expressed as mean, standard deviation, and percentages. P-values for baseline characteristics were based on independent sample ***t***-test for continuous measures and Chi-squared test for categories.

For objective measures, the unaffected arm of each subject was used as a control and the difference in objective measures between the affected and unaffected limbs was calculated. The difference in net measures (affected minus unaffected) from baseline to the final measurement, represented the change score. The change in objective measures was expressed as a percentage change. The percentage change (percentage of the objective measures changed by yoga trial) was calculated using the following formula:

Percentage change = baseline difference – post intervention difference / baseline difference x100

Where difference = affected arm – unaffected arm

The objective measures were expressed as means and 95% confidence intervals of means. A multilevel mixed effects linear regression analysis was applied in STATA version 12.0 using the xtmixed command to fit linear mixed models of the continuous objective measures and quality of life score to assess significance ($p<0.05$) of differences between the continued and discontinued yoga. Baseline information was adjusted in the linear mixed model.

Descriptive statistics for subjective measures were expressed as median and inter quartile range (IQR). The repeated measures proportional odds logistic regression analysis was used for subjective measures to assess the significance ($p<0.05$) of differences between continued and discontinued yoga groups.

Results

Subjective symptoms remained equivocal for both groups for tightness, burning, arm temperature, and pins and needles, and both groups experienced a reduction in symptoms of pain. Both groups perceived their limb size to have reduced slightly, more so in those who continued yoga. Although the quality of life scores declined by 3.6% in the continued group, they declined by 14.3% in the discontinued group.

Table 1 shows the baseline characteristics of the two groups and no significant differences between the groups. were found

Of the nine participants reporting continued use of yoga practice, only two were still attending weekly classes, the remaining seven had continued the home practice at least once per week and all intended to continue yoga practice in the future.

Of the nine participants who had not continued yoga practice, four indicated that they intended to practice yoga in the future. Two of these had commenced the home practice, however, one had been diagnosed and treated for bowel cancer and another had stopped over Christmas without returning to any yoga practice in the new year.

Objective measures

There were no statistically significant differences between the continued and

Table 1

Baseline characteristics of participants returning at six months follow-up

Characteristics	Yoga practice				
	Continued (n=9)		Discontinued (n=9)		
	n (%)	mean (SD)	n (%)	mean (SD)	P value*
Age (years)		65.0 (12.4)		60.4 (11.1)	0.42
BMI (kg/m^2)		30.2 (4.6)		31.5 (4.5)	0.57
Breast cancer history					
▸▸ Total mastectomy	7 (77.8)		7 (77.8)		1.00
▸▸ Partial mastectomy	2 (22.2)		2 (22.2)		1.00
▸▸ XRT of the axilla	5 (55.6)		3 (33.3)		0.34
▸▸ Aromatase therapy	5 (55.6)		5 (55.6)		1.00
Lymphoedema history – time since onset (years)					
▸▸ <3	4 (44.4)		4 (44.4)		1.00
▸▸ >10	5 (55.6)		5 (55.6)		1.00
Comorbidities					
▸▸ Hypertension	5 (55.6)		4 (44.4)		0.64
▸▸ Type 2 diabetes	1 (11.1)		0 (0)		0
▸▸ Injuries in the affected area	2 (22.2)		3 (33.3)		0.60
Compression sleeve					
▸▸ Never used	7 (77.8)		5 (55.6)		0.32
▸▸ Ever used (Intermittent/daily)	2 (22.2)		4 (44.4)		0.32
BIS**		267.8 (330.4)		349.4 (472.2)	0.68
Perometry**		382.5 (422.5)		546.2 (565.5)	0.50

*P-values are based on an independent sample *t*-test for continuous data and Chi-squared test for categories.; **Difference between affected and unaffected arms.
BIS = bioimpedance spectroscopy; BMI = body mass index; SD = standard deviation; XRT = X-ray therapy.

discontinued groups at 6-month follow-up, however, some trends can be seen (***Table 2***). BIS and perometry values both reduced slightly in the continued yoga group (14.3% and 9.8% reduction in BIS and perometry, respectively) where as both measures increased in the discontinued yoga group (25.4% and 16.7%).

Tonometry of the forearm indicated a slight softening in the continued yoga group and slight hardening in the discontinued group. Both groups experienced slight hardening of the upper arm and softening of the anterior and posterior torso.

Single case studies

Clinically relevant changes in individuals can illustrate trends seen in the data and two case studies of participants who continued with yoga and two who did not are present as examples. Selected results for these are shown in *Table 3.*

Discussion

The practice of yoga can be easily adapted taking into consideration lymphoedema exercise guidelines and the health status, physical abilities, and limitations of those who practice. The inclusion of breathing exercises mirrors current recommendations for all lymphoedemas and the possibility of managing stress though meditation may help reduce the psychosocial stresses of

Table 2

Results for Baseline and 6-month follow-up intervention between continued and discontinued yoga for 18 lymphoedema patients.

Measurements	Yoga practice						P-value
	Continued (n=9)			Discontinued (n=9)			
	Baseline Mean (95% CI)	6-month follow-up Mean (95% CI)	Reduction (%)	Baseline Mean (95% CI)	6-month follow-up Mean (95% CI)	Reduction (%)	
				Objective measures 1			
BIS	267.8 (51.9–483.6)	229.4 (65.8–393.1)	14.3	349.4 (40.9–657.9)	438.3 (87.1–789.5)	-25.4	0.98
Perometry	382.5 (106.5–658.5)	345.1 (74.8–615.4)	9.8	546.2 (176.7–915.7)	637.3 (216.3–1058.3)	-16.7	0.91
Tonometry forearm	-0.04 (-0.57–0.49)	-0.11 (-0.58–0.36)	-	-0.27 (-1.11–0.57)	-0.17 (-0.69–0.57)	-	0.79
Tonometry upper arm	-0.78 (-1.52–0.01)	0.25 (-0.85–1.35)	-	-0.17 (-1.03–0.69)	0.17 (-1.23–0.89)	-	0.80
Tonometry anterior torso	-0.46 (-1.38–0.46)	-0.47 (-1.84–0.90)	-	-2.35 (-3.55–1.15)	-1.54 (-2.36–0.72)	-	0.30
Tonometry posterior torso	-0.97 (-1.68–0.26)	-1.11 (-2.70–0.48)	-	-0.22 (-0.47–0.03)	-0.34 (-0.73–0.05)	-	0.32
				Subjective measures 2			
Pain	2.0(1.0–4.0)	1.0 (1.0–2.0)	-	2.0 (1.0–4.0)	1.0 (1.0–3.0)	-	0.90
Heaviness	4.5 (3.0–7.0)	3.0 (3.0–6.0)	-	3.0 (3.0–6.0)	3.0 (2.0–5.0)	-	0.86
Tightness	3.0 (2.0–7.0)	3.0 (1.0–6.0)	-	3.0 (2.0–6.0)	3.0 (1.0–4.0)	-	0.93
Burning sensation	1.0 (1.0–1.0)	1.0 (1.0–3.0)	-	1.0 (1.0–3.0)	1.0 (1.0–2.0)	-	0.85
Temperature	2.0 (1.0–5.0)	2.0 (1.0–3.0)	-	2.0 (1.0–2.0)	2.0 (1.0–4.0)	-	0.90
Pins and needles	1.0 (1.0–1.0)	1.0 (1.0–3.0)	-	1.0 (1.0–2.0)	1.0 (1.0–1.0)	-	0.64
Perception of limb size	7.0 (4.0–8.0)	4.0 (3.0–6.0)	-	4.5 (3.5–6.0)	3.0 (2.0–6.0)	-	0.56
Range motion	2.0 (2.0–5.0)	2.0 (1.0–3.0)	-	4.0 (2.0–5.0)	3.0 (2.0–4.0)	-	0.94
				QOL 1			
QOL score	5.6 (3.7–7.4)	5.4 (4.2–6.6)	3.6			14.3	

A multi-level mixed effects linear regression analsis was applied in STATA version 12.0 using the xtmixed command) to fit linear mixed models of the continuous objective measures and quality of life scores. A repeated measures proportional odds logistic regression analysis was used for subjective measures. The baseline information was adjusted in the linear mixed model. **BIS =** bioimpedance spectroscopy; CI = confidence interval; QOL = quality of life.

Table 3

Selected case study results

	Baseline	6-month follow-up	Change
CONTINUED YOGA			
Participant 7			
BMI (kg/m^2)	25	23.5	-1.5
BIS affected arm (mL)	2400	1985	-415
BIS unaffected arm (mL)	1370	1330	-40
Perometry affected arm (mL)	2455	2206.5	-248.5
Perometry unaffected arm (mL)	1587	1471.5	-115.5
SRS pain	5	1	-4
QOL	5.4	6.1	+0.7
Participant 25			
BMI (kg/m^2)	27.9	26.6	-1.3
BIS affected arm (mL)	1340	1280	-60
BIS unaffected arm (mL)	1335.5	1275	-60
Perometry affected arm (mL)	2450.5	2356.5	-94
Perometry unaffected arm (mL)	2337	2197	-140
SRS pain	6	2	-4
QOL	2.1	4.45	+2.35
DISCONTINUED YOGA			
Participant 5			
BMI (kg/m^2)	35.5	36.1	+0.5
BIS affected arm (mL)	2405	2760	+355
BIS unaffected arm (mL)	2040	2035	-5
Perometry affected arm (mL)	4571	5206	+635
Perometry unaffected arm (mL)	3677	3843	+165
SRS pain	5	7	+2
QOL	5.4	6.1	+0.7
Participant 6			
BMI (kg/m^2)	25.8	26.5	+0.7
BIS affected arm (mL)	2760	3025	+265
BIS unaffected arm (mL)	1725	1810	+85
Perometry affected arm (mL)	3448.5	3531	+82.5
Perometry unaffected arm (mL)	2206	2269.5	+63.5
SRS pain	4	7	+3
QOL	3	8	+5

BIS = bioimpedance spectroscopy; BMI = body mass index; QOL = quality of life; SRS = self-reported symptoms.

living with BCRL. Women with no prior yoga experience can participate easily and safely. As few as four instructor-led group classes may be enough to establish continued home practice for some women, while it is probable that for others this is not long enough to experience benefits or establish habits that would encourage continuation.

Yoga classes available in the community would not have the same group composition as the classes conducted within the present study, where all members of the group had BCRL and where group discussion and the exchange of experiences and ideas were biased toward that common condition. It is not known if similar results would be seen when women with BCRL participate in mixed classes not specifically adapted for lymphoedema.

This study adds to the growing number of studies exploring the effects of exercise in women with BCRL and strengthens the case for increasing activity of all kinds without fear of exacerbation. It might be ideal that any exercise regimen performed regularly would also reduce the extent of lymphoedema and its symptoms. However, more subtle effects that influence changes in lifestyle may impart benefits to the individual not captured by objective measuring tools.

The recommendation that women use compression garments during exercise was not explored in this study. However, yoga practice that can be performed in loose clothing that does not generally heat the body may be more comfortable to perform in compression garments than other more aerobic activities.

Increasing the awareness of the unique factors that influence women with BCRL's experiences of lymphedema may lead to better behavioural choices, potentially reducing the impact of lymphoedema over its lifetime. Providing women with tools to self-manage arm lymphoedema may empower them to be more proactive in their own self-care and this could potentially reduce the financial burden, both for the patient and health

services.

As yet, nothing is known about the role of yoga in risk reduction and lymphoedema prevention. However, the large number of breast cancer survivors using yoga for other purposes raises the possibility of investigations in this area in the future.

Conclusion

It is not possible to determine from this small sample if yoga is an effective management strategy for arm lymphoedema. However, the results of this study, including the absence of adverse effects during the intervention, and positive trends for some women who practiced yoga for 6 months' support further investigation. Evaluation of the potential contribution of yoga to comprehensive treatment, self-management regimens and risk reduction or prevention is indicated. Larger studies with extended intervention phases and longer follow-up periods are needed to confirm the validity of these findings and their applicability in managing other lymphoedemas.

Acknowledgements

Financial support from the Flinders Foundation and Flinders Medical Centre Volunteers provided funds for the hire of a venue, purchase of yoga mats and payment of the yoga instructor is acknowledged and greatly appreciated.

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