Heavy resistance training for women undergoing adjuvant chemotherapy at risk of developing breast cancer-related lymphedema

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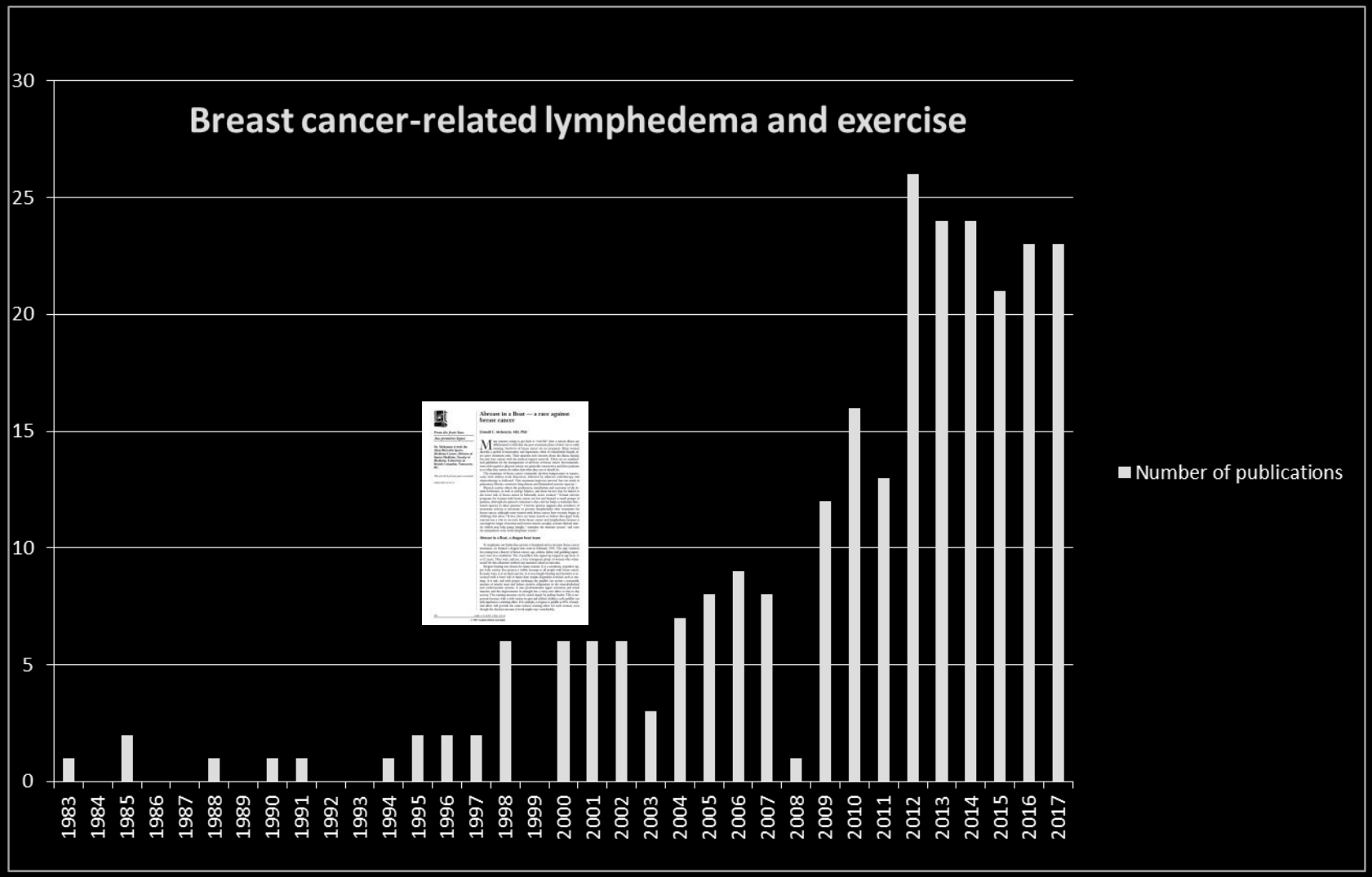
Abreast in a Boat-
a race against breast cancer (1998)

Publications



Consistent evidence supporting resistance exercise for breast cancer survivors at risk for lymphedema

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REVIEW

Safety and efficacy of progressive resistance training in breast cancer: a systematic review and meta-analysis

Birinder S. Cheema · Sharon L. Kilbreath · Paul P. Fahey · Geoffrey P. Delaney · Evan Atlantis

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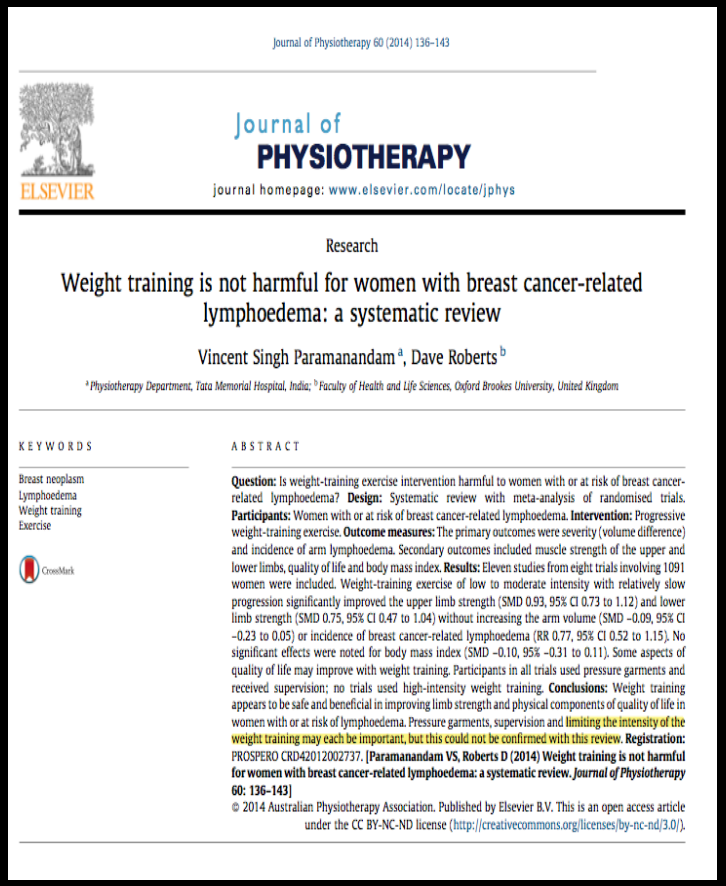
Abstract The purpose of this study was to assess the safety and efficacy of progressive resistance training (PRT) in breast cancer. Randomized controlled trials (RCTs) published to November 2013 that reported on the effects of PRT (>6 weeks) on breast cancer-related lymphedema (BCRL) (incidence/exacerbation, arm volume, and symptom severity), physical functioning (upper and lower body muscular strength), and health-related quality of life (HRQoL) in breast cancer patients were included. Of 446 citations retrieved, 15 RCTs in 1,652 patients were included and yielded five studies on BCRL incidence/exacerbation ($N = 647$), four studies on arm volume ($N = 384$) and BCRL symptom severity ($N = 479$), 11 studies on upper body muscular strength ($N = 1,252$), nine studies on lower body muscular strength ($N = 1,079$), and seven studies on HRQoL ($N = 823$). PRT reduced the risk of BCRL versus control conditions [OR = 0.53 (95 % CI 0.31–0.90); $I^2 = 0$ %] and did not worsen arm volume or symptom severity (both SMD = −0.07). PRT significantly improved upper [SMD = 0.57 (95 % CI 0.37–0.76); $I^2 = 58.4$ %] and lower body muscular strength [SMD = 0.48 (95 % CI 0.30–0.67); $I^2 = 46.7$ %] but not HRQoL [SMD = 0.17 (95 % CI −0.03 to 0.38); $I^2 = 47.0$ %]. The effect of PRT on HRQoL became significant in our sensitivity analysis when two studies conducted during adjuvant chemotherapy [SMD = 0.30 (95 % CI 0.04–0.55), $I^2 = 37.0$ %] were excluded. These data indicate that PRT improves physical functioning and reduces the risk of BCRL. Clinical practice guidelines should be updated to inform clinicians on the benefits of PRT in this cohort.

Electronic supplementary material The online version of this article (doi:10.1007/s10549-014-3162-9) contains supplementary material, which is available to authorized users.



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Research

Weight training is not harmful for women with breast cancer-related lymphoedema: a systematic review

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KEYWORDS

Breast neoplasm
Lymphoedema
Weight training
Exercise

ABSTRACT

Question: Is weight-training exercise intervention harmful to women with or at risk of breast cancer-related lymphoedema? **Design:** Systematic review with meta-analysis of randomised trials. **Participants:** Women with or at risk of breast cancer-related lymphoedema. **Intervention:** Progressive weight-training exercise. **Outcome measures:** The primary outcomes were severity (volume difference) and incidence of arm lymphoedema. Secondary outcomes included muscle strength of the upper and lower limbs, quality of life and body mass index. **Results:** Eleven studies from eight trials involving 1091 women were included. Weight-training exercise of low to moderate intensity with relatively slow progression significantly improved the upper limb strength (SMD 0.93, 95% CI 0.73 to 1.12) and lower limb strength (SMD 0.75, 95% CI 0.47 to 1.04) without increasing the arm volume (SMD −0.09, 95% CI −0.23 to 0.05) or incidence of breast cancer-related lymphoedema (RR 0.77, 95% CI 0.52 to 1.15). No significant effects were noted for body mass index (SMD −0.10, 95% −0.31 to 0.11). Some aspects of quality of life may improve with weight training. Participants in all trials used pressure garments and received supervision; no trials used high-intensity weight training. **Conclusions:** Weight training appears to be safe and beneficial in improving limb strength and physical components of quality of life in women with or at risk of lymphoedema. Pressure garments, supervision and limiting the intensity of the weight training may each be important, but this could not be confirmed with this review. **Registration:** PROSPERO CRD42012002737. **[Paramanandam VS, Roberts D (2014) Weight training is not harmful for women with breast cancer-related lymphoedema: a systematic review. *Journal of Physiotherapy* 60: 136–143]**

Why resistance exercise?

Profits from resistance training	**Sequelae from breast cancer treatment**
Increases bone density*	At risk of developing osteoporosis
Increases muscle mass*	Sarcopenia, metabolic syndrome
Increased vitality*	Fatigue
Increased muscular strength*	Loss of strength
Improved ”body image”	Negative body perception
Increased quality of life parameters	Reduced quality of life
Prevent musculoskeletal injuries	lymphedema?

PhD- three studies

Study	Design	Purpose	Outcome
1	Cross-section (n = 149)	Determine prevalence of BCRL in breast cancer patients who had participated in a an exercise intervention utilizing heavy load RT	Telephone questionnaire: Clinically diagnosed BCRL reported by participant
2	Cross-over (n = 20)	Determine acute changes in extracellular fluid and arm volume after a session of low and heavy load RT in women receiving adjuvant chemotherapy at high risk of developing BCRL.	BIS: Arm extracellular fluid DXA: Arm volume VAS: Symptom Severity
3	RCT (n = 154)	Determine between group differences after 12 weeks of 1) high intensity exercise intervention including heavy RT and 2) a pedometer intervention, in a sedentary population at risk of developing BCRL.	DXA: Arm volume BIS (sub-group n=100): Arm extracellular fluid VAS: Symptom severity QOL: EORTC QLQ-BR23

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BMC Cancer

STUDY PROTOCOL Open Access

A randomized cross-over trial to detect differences in arm volume after low- and heavy-load resistance exercise among patients receiving adjuvant chemotherapy for breast cancer at risk for arm lymphedema: study protocol

Kira Bloomquist[1*], Sandi Hayes[2], Lis Adamsen[1], Tom Møller[1], Karl Bach Christensen[3], Bent Ejlertsen[4] and Peter Oturai[5]

Abstract

Background: In an effort to reduce the risk of breast cancer-related arm lymphedema, patients are commonly advised to avoid heavy lifting, impacting activities of daily living and resistance exercise prescription. This advice lacks evidence, with no prospective studies investigating arm volume changes after resistance exercise with heavy loads in this population. The purpose of this study is to determine acute changes in arm volume after a session of low- and heavy-load resistance exercise among women undergoing adjuvant chemotherapy for breast cancer at risk for arm lymphedema.

Methods/Design: This is a randomized cross-over trial. *Participants*: Women receiving adjuvant chemotherapy for breast cancer who have undergone axillary lymph node dissection will be recruited from rehabilitation centers in the Copenhagen area. *Intervention*: Participants will be randomly assigned to engage in a low- (two sets of 15–20 repetition maximum) and heavy-load (three sets of 5–8 repetition maximum) upper-extremity resistance exercise session with a one week wash-out period between sessions. *Outcome*: Changes in extracellular fluid (L-Dex score) and arm volume (ml) will be assessed using bioimpedance spectroscopy and dual-energy x-ray absorptiometry, respectively. Symptom severity related to arm lymphedema will be determined using a visual analogue scale (heaviness, swelling, pain, tightness). Measurements will be taken immediately pre- and post-exercise, and 24- and 72-hours post-exercise. *Sample size*: A sample size of 20 participants was calculated based on changes in L-Dex scores between baseline and 72-hours post exercise sessions.

Discussion: Findings from this study are relevant for exercise prescription guidelines, as well as recommendations regarding participating in activities of daily living for women following surgery for breast cancer and who may be at risk of developing arm lymphedema.

Trial registration: Current Controlled Trials ISRCTN97332727. Registered 12 February 2015.

Keywords: Lymphedema, Breast cancer, Resistance exercise

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OPEN

Heavy-Load Lifting: Acute Response in Breast Cancer Survivors at Risk for Lymphedema

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[1]*University Hospitals Centre for Health Research (UCSF), Copenhagen University Hospital, Copenhagen, DENMARK;* [2]*Department of Clinical Physiology, Nuclear Medicine and PET, Copenhagen University Hospital, Copenhagen, DENMARK;* [3]*Institute of Health and Biomedical Innovation, School of Public Health and Social Work, Queensland University of Technology, Kelvin Grove, Queensland, AUSTRALIA;* [4]*Department of Public Health, Section of Biostatistics, University of Copenhagen, Copenhagen, DENMARK; and* [5]*DBCG, Afsnit 2301, Copenhagen University Hospital, Copenhagen, DENMARK*

ABSTRACT

BLOOMQUIST K., P. OTURAI, M. L. STEELE, L. ADAMSEN, T. MØLLER, K. B. CHRISTENSEN, B. EJLERTSEN, and S. C. HAYES. Heavy-Load Lifting: Acute Response in Breast Cancer Survivors at Risk for Lymphedema. *Med. Sci. Sports Exerc.*, Vol. 50, No. 2, pp. 187–195, 2018. Purpose: Despite a paucity of evidence, prevention guidelines typically advise avoidance of heavy lifting in an effort to protect against breast cancer–related lymphedema. This study compared acute response in arm swelling and related symptoms after low- and heavy-load resistance exercise among women at risk for lymphedema while receiving adjuvant taxane-based chemotherapy. Methods: This is a randomized, crossover equivalence trial. Women receiving adjuvant taxane-based chemotherapy for breast cancer who had undergone axillary lymph node dissection (*n* = 21) participated in low-load (60%–65% 1-repetition maximum, two sets of 15–20 repetitions) and heavy-load (85%–90% 1-repetition maximum, three sets of 5–8 repetitions) upper-extremity resistance exercise separated by a 1-wk wash-out period. Swelling was determined by bioimpedance spectroscopy and dual-energy x-ray absorptiometry, with breast cancer–related lymphedema symptoms (heaviness, swelling, pain, tightness) reported using a numeric rating scale (0–10). Order of low- versus heavy-load was randomized. All outcomes were assessed before, immediately after, and 24 and 72 h after exercise. Generalized estimating equations were used to evaluate changes over time between groups, with equivalence between resistance exercise loads determined using the principle of confidence interval inclusion. Results: The acute response to resistance exercise was equivalent for all outcomes at all time points irrespective of loads lifted, with the exception of extracellular fluid at 72 h after exercise with less swelling after heavy loads (estimated mean difference, −1.00; 95% confidence interval, −3.17 to 1.17). Conclusions: Low- and heavy-load resistance exercise elicited similar acute response in arm swelling and breast cancer–related lymphedema symptoms in women at risk for lymphedema receiving adjuvant taxane-based chemotherapy. These represent important preliminary findings, which can be used to inform future prospective evaluation of the long-term effects of repeated exposure to heavy-load resistance exercise. Key Words: ARM SWELLING, BREAST CANCER, DOSE–RESPONSE, STRENGTH TRAINING

Breast cancer–related arm lymphedema (BCRL) is a chronic condition initially characterized by regional swelling of the arm or hand due to increases in protein-rich extracellular fluid, affecting approximately 20% of breast cancer survivors as a consequence of treatment (1,2). The adverse effects of BCRL are well described in the literature, negatively affecting daily functions (3,4) and social, emotional, and psychological well-being (4,5).

More extensive surgery to the chest wall, radiotherapy, chemotherapy, and being overweight and/or physically inactive have been consistently associated with increased BCRL risk (1). However, the extent of lymph node removal is considered the strongest risk factor, with BCRL incidence four times higher after axillary lymph node dissection compared with sentinel-node biopsy (1). Despite the high-quality evidence in support of specific risk factors, the ability to predict who will develop BCRL is limited.

Historically, breast cancer survivors were advised to refrain from resistance exercise as a means of preventing BCRL (6,7). However, results from systematic reviews of clinical trials consistently indicate that resistance exercise elicits gains in muscle strength and physical components of quality of life without increased risk for BCRL (6–9).

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Purpose

To assess the initial lymphatic response to low-load compared to heavy-load resistance exercise in breast cancer survivors at risk for lymphedema during taxane-based chemotherapy

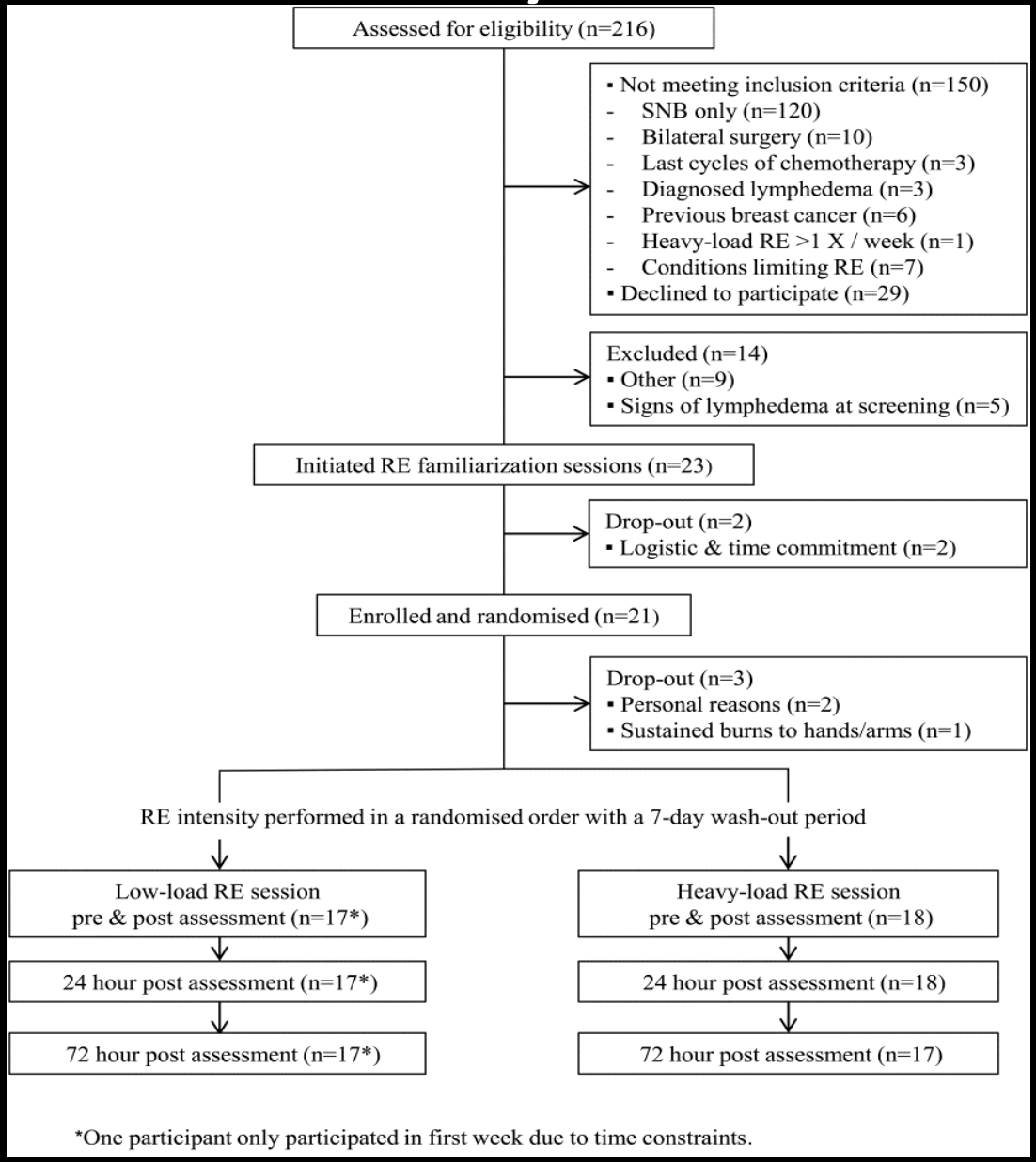
Inclusion criteria

- Receiving standard adjuvant chemotherapy for stage I-III breast cancer
- Unilateral breast surgery and axillary dissection
- No previous breast cancer

Exclusion criteria

- Pre-existing lymphedema
- Conditions limiting resistance exercise
- Participating in heavy-load resistance exercise (>1 /wk) within the last month

Study flow


Assessed for eligibility (n=216)
▪ Not meeting inclusion criteria (n=150)
- SNB only (n=120)
- Bilateral surgery (n=10)
- Last cycles of chemotherapy (n=3)
- Diagnosed lymphedema (n=3)
- Previous breast cancer (n=6)
- Heavy-load RE >1 X / week (n=1)
- Conditions limiting RE (n=7)
▪ Declined to participate (n=29)
Excluded (n=14)
▪ Other (n=9)
▪ Signs of lymphedema at screening (n=5)
Initiated RE familiarization sessions (n=23)
Drop-out (n=2)
▪ Logistic & time commitment (n=2)
Enrolled and randomised (n=21)
Drop-out (n=3)
▪ Personal reasons (n=2)
▪ Sustained burns to hands/arms (n=1)
RE intensity performed in a randomised order with a 7-day wash-out period
Low-load RE session
pre & post assessment (n=17*)
24 hour post assessment (n=17*)
72 hour post assessment (n=17*)
Heavy-load RE session
pre & post assessment (n=18)
24 hour post assessment (n=18)
72 hour post assessment (n=17)
*One participant only participated in first week due to time constraints.

Training sessions

All sessions

- Supervised, cardio warm-up, no compression sleeve
- Four exercises
  - Bicep curl
  - Chest press
  - Lat pull down
  - Tricep extension

2 familiarization sessions

- 1 RM testing

2 experimental sessions

- Heavy-load (3 sets of 5-8 RM)
- Low-load (2 sets of 15-20 RM)

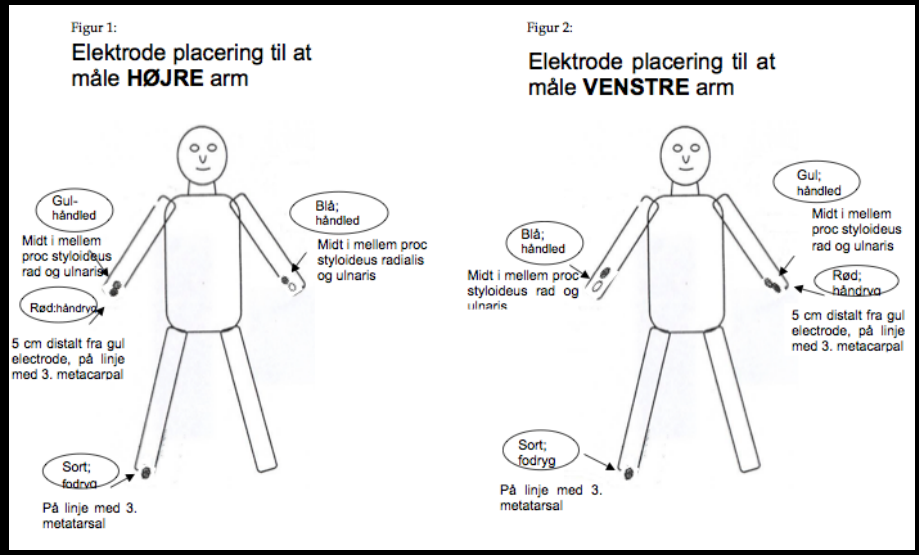
Participant Characteristics

Variables	Mean ± SD / n (%) /Median (range)
Age	45.29 ± 9.17 / 46 (23-60)
BMI	25.29 ± 4.72
Cancer stage	
II	15 (71.43)
III	6 (28.57)
Breast surgery	
Lumpectomy	8 (38.10)
Mastectomy	13 (61.90)
Surgery on dominant side	11 (52.38)
Nodes removed	21.71 ± 7.84
Metastatic nodes	5.67 ± 7.04 / 2 (1-25)
Seroma drainage	5.48 ± 3.43
Chemotherapy	
3xCE/3x3 docetaxel	10 (47.62)
3xCE/3X3 series 1 wkly paclitaxel	11 (52.38)
Axillary webbing at screening	8 (38.10)
L-Dex at screening	-0.08 ± 2.23

Measurement Methods / Outcomes

- Bioimpedance Spectroscopy (BIS) / Extracellular fluid
- Dual x-ray absortiometry (DXA) / % difference in interarm volume
- Numeric Rating scale (NRS) / Interarm difference in lymphedema symptoms

BIS



- Based on the resistance to an imperceptible current passed through the arm-
- Direct measure of extracellular fluid
- ↑ Fluid / ↓Impedance (resistance)
- High sensitivity to detect latent stage lymphedema
- L-Dex score: taking arm dominance into account; validated cut-off of 10

DXA (arm scans)

Densities for calculating volume

- Fat (0.9 g/ml)
- Lean mass (1.1 g/ml)
- Bone mineral content (1.85 g/ml)

Measure 1

	BMC	Fedt	Muskel	Væv	ml
Højre overarm	47,7	408	553	961	**981,8443898**
Højre underarm	50,4	183	487	670	**673,3038493**
Højre hånd	28,1	61	190	251	**255,6942397**
Højre arm	126,2	652	1230	**1882**	**1910,842479**
Venstre overarm	48	444	599	1043	**1063,824734**
Venstre underarm	43,8	156	491	647	**643,3726454**
Venstre hånd	23,6	65	185	250	**253,1607972**
Venstre arm	115,4	665	1275	**1940**	**1960,358176**

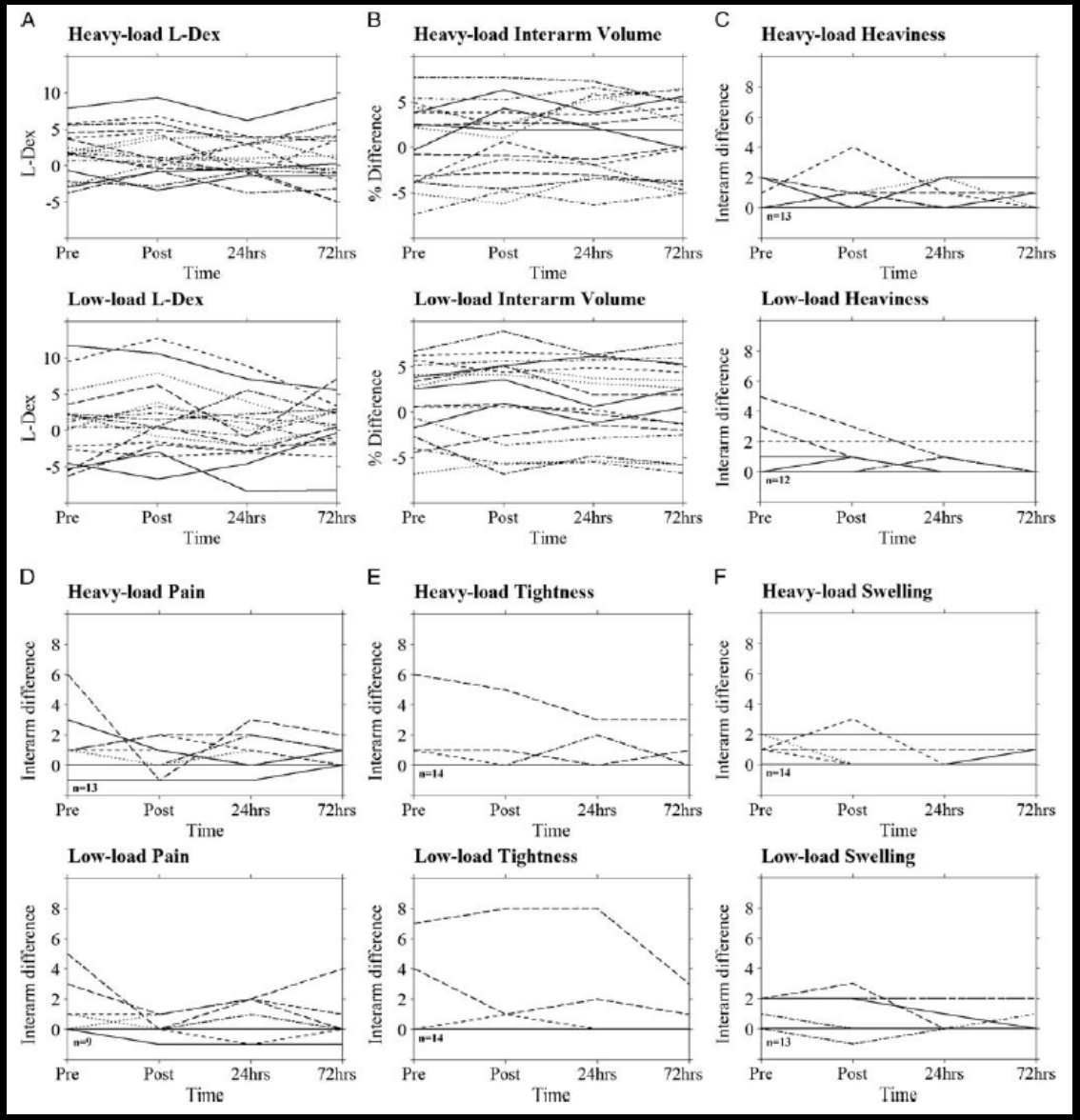
Gjorup et al., 2010

NRS (0- 10 scale)

Self-reported BCRL symptom severity of each arm

- Heaviness
- Tightness
- Pain
- Swelling

Varied individual response



Main findings

TABLE 4. Equivalence between resistance exercise intensities for all outcomes (n = 17).

	Estimated Mean Difference[b]	Equivalence 90% CI
L-Dex (±3.0)[a]		
Postexercise	−0.97	−2.09 to 0.16
24 h postexercise	−0.14	−1.63 to 1.35
72 h postexercise	−1.00	**−3.17 to 1.17**
Interarm volume % difference (±3.0)[a]		
Postexercise	0.21	−0.89 to 1.31
24 h Postexercise	1.09	0.41 to 1.78
72 h Postexercise	0.96	−0.09 to 2.02
Interarm difference for pain (±1.0)[a]		
Postexercise	0	−0.43 to 0.43
24 h postexercise	−0.06	−0.58 to 0.46
72 h postexercise	−0.06	−0.61 to 0.49
Interarm difference for heaviness (±1.0)[a]		
Postexercise	0.24	−0.23 to 0.70
24 h postexercise	0.18	−0.32 to 0.67
72 h postexercise	0.24	−0.38 to 0.85
Interarm difference for tightness (±1.0)[a]		
Postexercise	−0.06	−0.45 to 0.34
24 h postexercise	−0.11	−0.50 to 0.27
72 h postexercise	0.20	−0.37 to 0.77
Interarm difference for swelling (±1.0)[a]		
Postexercise	0	−0.33 to 0.33
24 h postexercise	0	−0.33 to 0.33
72 h postexercise	0.06	−0.42 to 0.54

Boldface indicates that equivalence was not demonstrated.

[a]Equivalence margin.

[b]Estimated mean difference calculated using a GEE model with heavy load as comparator (heavy minus low).

Conclusion

- Acute lymphatic response was similar irrespective of exercise prescription
- Should be confirmed with repeated bouts
- Found no evidence to suggest that heavy-load lifting need be avoided
- Varied response highlights need for an individualized approach

Patient education

- Informed about individual life-long risk of lymphedema
- Progressive upper-body activity in accordance with symptoms
- Encouraged to participate in activities of daily living without restrictions
- Encouraged to maintain or adopt healthy lifestyle (BMI & physical activity)
- Informed about symptoms of lymphedema and to react if they occur

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