BRIEF RESEARCH REPORT

Breast Cancer Survivors' Compliance to Personal Training Versus Group-Based Exercise

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ABSTRACT

Background: This study reports on breast cancer survivors' compliance to the exercise prescription (ExR*x*) of a personal training (PT) or group-based (GB) exercise intervention.

Methods: Breast cancer survivors who had completed chemotherapy and/or radiation within the previous year were randomly assigned to PT or GB. All participants completed supervised aerobic and resistance training sessions twice per week for 8 weeks. Compliance to aerobic and resistance exercise intensity (i.e., % heart rate reserve, and % 1-repetition maximum [1-RM]) and aerobic exercise duration ExR*x* is reported, and average aerobic and resistance exercise intensity was calculated. Independent *t* tests compared percent compliance and average intensity between PT and GB. The proportion of participants above or below ExR*x* was examined using frequencies.

Results: ExR*x* compliance ranged from 64% to 98%. Compliance to aerobic exercise intensity and duration was higher in PT than GB ($P < 0.05$). Average upper body resistance training exercise intensity was higher in PT (73% 1-RM) vs GB (56% 1-RM) ($P = 0.01$). Noncompliance to aerobic ExR*x* was more commonly due to intensity or duration below the ExR*x*. Noncompliance to resistance training ExR*x* was distributed equally above or below ExR*x*.

Conclusion: Compliance to aerobic ExR*x* and average upper body resistance training intensity was higher in PT, suggesting that exercise professionals in GB settings should consider closely monitoring breast cancer survivors' adherence to ExR*x*.
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Keywords: physical activity, survivorship, intervention, adherence

INTRODUCTION

There are more than three million breast cancer survivors (BCS) in the United States (1). BCS often experience long-lasting side effects that have deleterious effects on fitness (e.g., muscular strength, aerobic capacity) and quality of life (2). Exercise mitigates these side effects (3) and reduces risk of recurrence and mortality (4). Based on the evidence of the benefits of exercise interventions for BCS, exercise guidelines have been developed (5); however, these guidelines are derived from the exercise prescription (ExR*x*) participants were *told to complete*, not what was *actually completed* (i.e., ExR*x* compliance) (6–8).

Previous reviews of exercise interventions for cancer survivors have found that reporting of ExR*x* compliance is inconsistent and incomplete, leaving practitioners to base

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exercise programming on prescribed exercise rather than the actual exercise dose completed (6,7). In a review by Winters-Stone et al (6), only 2 of 35 studies reported all details regarding compliance to the ExR*x* with the majority of studies only reporting frequency of exercise and type of exercise completed (6). With this lack of ExR*x* compliance reporting, the ability to determine whether the ExR*x* was efficacious for improving outcomes, or if a lower or higher intensity, duration, or volume of exercise is needed cannot be ascertained. Thus, expanding ExR*x* reporting of attendance rates to include ExR*x* compliance reporting is needed to aid exercise professionals in prescribing the appropriate exercise frequency, intensity, time, and type (FITT) necessary to improve BCS-related outcomes.

Despite the scarcity of reporting ExR*x* compliance, exercise interventions and programs for BCS continue to grow in popularity (7,9–11). Supervised exercise interventions elicit positive effects on quality of life and fitness (12) and can be delivered individually (personal training [PT]) or in a group-based (GB) setting. Both delivery modalities have been found to be effective for improving BCS-related outcomes (13,14). Group-based may be less resource-intensive compared to PT (i.e., lower participant-to-instructor ratio costs) (15), but to the best of our knowledge, no studies have examined whether these delivery modalities are comparable in terms of ExR*x* compliance. In a recent pilot study among BCS, we found that percent compliance to aerobic and resistance ExR*x* was similar between PT and GB (13); however, analyses were limited to yes/no responses of meeting ExR*x* guidelines, neglecting further details of compliance to individual components of the ExR*x*, specifically intensity or duration, or reasons for noncompliance (e.g., above/below ExR*x*) (13,14). This additional information will allow exercise professionals to evaluate if the ExR*x* prescribed is sufficient to improve BCS-related outcomes, or if ExR*x* parameters need to be adjusted to elicit benefits (i.e., higher or lower intensity or volume of exercise).

There is a need to expand ExR*x* compliance reporting in order to better understand the associations between exercising dosing and BCS-related outcomes and examine if ExR*x* compliance is similar between BCS completing a PT or GB intervention. This information will contribute to the optimization and tailoring of ExR*x* in future interventions. However, this information is difficult to collect as it requires increased study staff and/or participant burden.

Thus, the aims of this study, using previously collected data, were to (a) examine percent compliance to aerobic and resistance ExR*x*, and the average aerobic and resistance exercise intensity performed during a PT and GB exercise intervention, and (b) determine whether noncompliance was above or below ExR*x*.

METHODS

Data were collected during an 8-week, pilot, randomized controlled trial comparing the effects of a PT versus GB intervention on fitness, quality of life, and physical activity (13). Participants were women diagnosed with stage I or stage II BC who had completed treatment within 1 year of enrollment. All participants received 2 supervised exercise sessions per week. For both PT and GB, the twice weekly exercise sessions were supervised by a research assistant and lasted approximately 1 h including a 5-min warm-up, 20 to 25 min of aerobic exercise (self-selected treadmill, elliptical, stationary bike, or other modality), 20 to 25 min of resistance training (RT) (approximately 4-6 exercises targeting major muscle groups), and a 5-min cool down. Group size ranged from 3 to 5 participants. Informed consent was obtained from all participants, and all procedures performed in this study were in accordance with the ethical standards of Colorado State University's institutional review board.

Baseline Assessments

Participants completed fitness assessments to create individualized ExR*x* and ensure safety during exercise. Aerobic fitness was measured using a submaximal modified Balke exercise test (16,17) with a stopping point of 85% of heart rate reserve (HRR). Participants performed 1-repetition maximal (1-RM) resistance testing following ACSM Guidelines for Testing and Prescription on plate-loaded chest and leg press machines (17).

ExR*x* Compliance

To monitor aerobic ExR*x* compliance, research assistants recorded exercise duration in minutes and heart rate via a wrist worn Polar A300 (Polar Electro, Inc., Bethpage, New York) heart rate monitor with chest strap. Compliance to RT intensity was monitored for chest and leg press exercises, at 1 session per week, by research assistants recording load (pounds) performed. Compliance to ExR*x* was defined as aerobic duration ≥20 min, aerobic intensity between 50% and 80% HRR, and chest and leg press between 50% and 80% 1-RM. Percent compliance was calculated separately for aerobic duration, aerobic intensity, upper body RT intensity (i.e., chest press), and lower body RT intensity (i.e., leg press), by dividing the total number of sessions each participant was compliant, by the total number of sessions attended. Average exercise intensity for aerobic, upper and lower body (i.e., %HRR, and %1-RM) were recorded for each participant at each session, then averaged across all exercise sessions attended. When participants were noncompliant to the ExR*x*, research assistants documented whether the deviation was above or below ExR*x*, and any specific reasons reported by the participant.

Statistical Analyses

Baseline descriptive information, percent compliance, and average exercise intensity was summarized using frequencies, or means and standard deviation. Independent *t* tests compared differences between PT and GB in (a) percent compliance to aerobic exercise duration and intensity, upper and lower body RT intensity, and (b) average aerobic and RT exercise intensity. Only participants who completed the intervention were included in analyses. Statistical analyses were conducted using IBM SPSS Statistics version 25.0

(IBM Corporation, Armonk, New York), statistical significance set at $P < 0.05$.

RESULTS

Twenty-seven participants enrolled, and 88.9% (PT n = 12, GB n = 12) completed the study. On average, participants attended 14.6 ± 1.5 out of 16 total sessions (PT = 15.83 ± 0.99, GB = 13.33 ± 0.96). Baseline characteristics of the participants (N = 24) who completed the study are presented in Table 1. As previously reported (13), there were no differences in medical factors, demographics, physical activity, or fitness between GB or PT at baseline.

Percent compliance was higher in PT for aerobic duration and aerobic intensity but similar in GB and PT for upper body RT (chest press), and lower body RT (leg press). ExR*x* compliance results are displayed in Table 2. Average aerobic exercise intensity was similar between PT (60.6% ± 7.4%), and GB (64.5% ± 13.4% HRR) (P = 0.40). Average upper

TABLE 1. Baseline participant characteristics (N = 24).

	PT (n = 12)	Group (n = 12)	Total (n = 24)
Age, (y) range	51.9 ± 8.3 42-69	51.7 ± 9.1 29-62	51.8 ± 8.5
BMI, ($kg \cdot m^{-2}$) range	29.6 ± 8.1 20.4-44.5	28.3 ± 7.4 19.4-40.3	28.9 ± 7.6
Education, (%)	n = 11	n = 12	n = 23
Post high school	83.4	100	62.5
High school diploma or less	9.1	0	8.4
Missing or no response	8.3	0	4.2
Ethnicity, (%)			
White	91.7	83.3	87.5
Other	8.3	16.7	12.5
Income, (%)			
$50,000 to 99,999	75	58.3	66.7
$100,000 to 149,999	8.3	33.3	20.8
More than $150,000	8.3	0	4.2
Missing or no response	8.3	8.3	8.3
Self-reported physical activity[a], ($MET \cdot min^{-1} \cdot wk^{-1}$) range	1,656 ± 1,663 0-4,650	1,827 ± 1,867 297.0-6444	1,741 ± 1,731.5
Chest Press 1-RM, (lbs) range	78 ± 14.5 (n = 10) 53-98	77 ± 2 48-101	77 ± 15
Leg Press 1-RM, (lbs) range	184 ± 38 136-238	191 ± 38 136-255	188 ± 37
Estimated VO_{2max} at 85% HRR, ($ml \cdot kg^{-1} \cdot min^{-1}$) range	26.8 ± 7.8 14.7-44.6	26.1 ± 8.1 15.7-41.1	26.4 ± 7.8
Time since diagnosis, (mo) range	14 ± 4.5 (9.8-19) (n = 11)	13.2 ± 5.4 (n = 11) 6-22	13.8 ± 4.9
Time since surgery, (mo) range	10.2 ± 3.8 2.8-16	11.2 ± 4.8 3.5-18.5	10.7 ± 4.3
Cancer Stage, (%)			
I	33	42	38
II	58	58	58
Did not report	8	0	4
Received chemotherapy, (%)	100	100	100
Waist circumference (cm)	89.2 ± 16.1 68-115	86.7 ± 18.3 65-119	88 ± 16.9

1-RM = 1-repetition maximum; BMI = body mass index; HRR = heart rate reserve; MET = metabolic equivalents of task; PT = personal training. Values represented as mean ± SD except where indicated

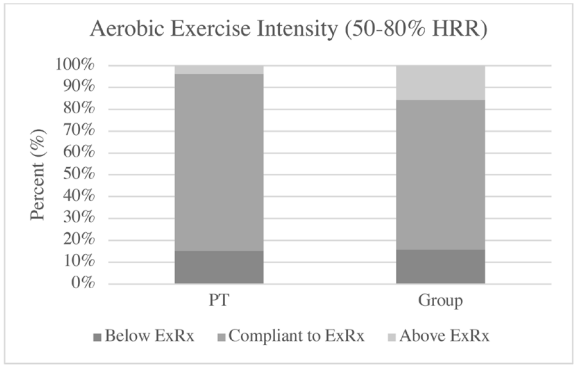
[a]Physical activity was measured using the International Physical Activity Questionnaire-Short (18)

TABLE 2. ExR*x* compliance.

	Percent Compliance, mean ± SD		*P*-value
	PT	GB	
Aerobic			
Duration (≥ 20 min)	98 ± 5.4	92 ± 5.9	0.01
Intensity (50%-80% HRR)	80 ± 18	64 ± 21	0.05
Chest press intensity (50%-80% 1-RM)	82 ± 32	74 ± 22	0.51
Leg press intensity (50%-80% 1-RM)	79 ± 23	85 ± 26	0.54

1-RM = 1-repetition maximum; ExR*x* = exercise prescription; HRR = heart rate reserve

body RT intensity was higher in PT (73.3% ± 20.3% of 1-RM) than GB (56.1% ± 9.5% of 1-RM) ($P = 0.01$). Average lower body RT intensity was similar between PT (64.7% ± 9.5% of 1-RM) and GB (63.0% ± 13.9% of 1-RM) ($P = 0.73$).



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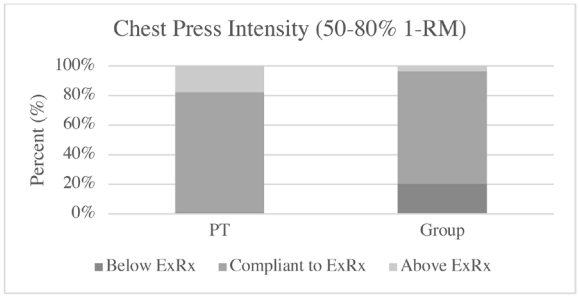

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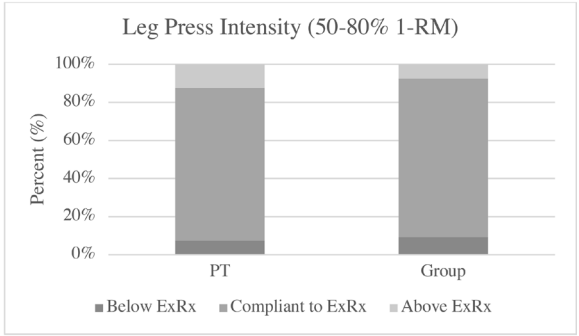

(c)

FIGURE 1. Percent of recorded instances of ExR*x* compliance that were within ExR*x* parameters, or above or below ExR*x* parameters. ExR*x* = exercise prescription; PT = personal training; HRR = heart rate reserve; 1-RM = 1-repetition maximum.

The percentage of noncompliance (i.e., instances of noncompliance for all participants/total number of instances for all participants) that was above or below ExR*x* intensity for aerobic, upper body RT, and lower body RT intensity are displayed in Figure 1. Reasons for noncompliance, specific to those below ExR*x*, were reported. These included: "not feeling well" (2 reports), orthopedic surgery (3 reports), or musculoskeletal injury/discomfort (knee and low back; 3 reports), all of which were unrelated to the intervention. There were no reasons for being above ExR*x* parameters documented.

DISCUSSION

This study examined compliance to aerobic, upper and lower body RT ExR*x* among BCS participating in a PT or GB exercise intervention. Overall, compliance ranged from 64% to 98%, and average exercise intensity was within ExR*x* parameters. Compliance to aerobic exercise duration and intensity was higher in PT, but when noncompliant, the majority were below ExR*x* in PT whereas noncompliance to ExR*x* in GB was more commonly above ExR*x*. Compliance to upper body RT was similar between groups, but average intensity (% of 1-RM) was higher in PT. The majority of noncompliance to upper body RT intensity in PT was above ExR*x* parameters whereas the majority of noncompliance to upper body RT intensity in GB was below ExR*x* parameters.

Aerobic and RT exercise improves common symptom sequelae associated with breast conservation/reconstructive surgeries and systemic treatment that often contribute to diminished fitness and quality of life (10,19–21). For RT, the majority of participants in this study were able to exercise within the ExR*x* intensity, with some participants exceeding the parameters. This may be due to an underestimation of 1-RM at baseline, suggesting a need for retesting strength parameters at midintervention, particularly for those who are RT naïve at baseline.

Strengths of this study were the additional details (i.e., average %HRR, %1-RM, and duration) beyond the adherence/attendance reported in previous studies (6,9), and comparison of ExR*x* compliance between PT and GB delivery modalities. We were also able to provide additional

information about whether participants were unable to achieve the ExR*x* or were exceeding ExR*x*. Limitations of this study include small sample size and limited generalizability due to the small, homogenous sample. ExR*x* compliance was not a predetermined outcome of this study, therefore, more ExR*x* compliance information regarding exercises other than chest and leg press for RT were not recorded. Additionally, sets and reps for RT was not well-documented, and therefore compliance to RT volume could not be fully reported.

Findings from this study provide novel information regarding the exercise completed by BCS during a supervised PT or GB exercise intervention. Overall, BCS were able to comply with the ExR*x* of the intervention, at an intensity consistent with exercise guidelines for cancer survivors (5). When comparing delivery modality, compliance to aerobic exercise ExR*x* for duration and intensity was lower in the GB versus PT setting, suggesting that trainers may need to be more attentive in monitoring aerobic ExR*x* compliance in a GB setting. There is a significant burden on research staff associated with documenting ExR*x* compliance during exercise interventions, thus future studies should plan to collect and analyze compliance data a priori to account for the additional staff training and time needed to ensure detailed reporting of ExR*x* compliance.

Clinical Implications

BCS were able to comply with the ExR*x* in both a PT and GB exercise intervention. However, findings from this study suggest that exercise professionals may consider closely monitoring participants' aerobic exercise duration and intensity in GB settings. Additionally, planning for how to document ExR*x* compliance and reasons for noncompliance during exercise interventions for BCS can help inform exercise professionals as to what extent BCS are able to achieve recommendations for aerobic and resistance exercise.

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REFERENCES

1. Runowicz CD, Leach CR, Henry NL, Henry KS, Mackey HT, Cowens-Alvarado RL, Cannady RS, Pratt-Chapman ML, Edge SB, Jacobs LA, Hurria A, Marks LB, LaMonte SJ, Warner E, Lyman GH, Ganz PA. American Cancer Society/American Society of Clinical Oncology breast cancer survivorship care guideline. J Clin Oncol. 2016;34(6): 611–35.
2. Cleeland CS, Zho F, Change VT, Sloan JA, O'Mara AM, Gilman PB, Weiss M, Mendoza TR, Lee JW, Fisch MJ. The symptom burden of cancer: evidence for a core set of cancer-related and treatment-related symptoms from the Eastern Cooperative Oncology Group Symptom Outcomes and Practice Patterns study. Cancer. 2013;119(24):4333–40.
3. Fong DY, Ho JWC, Hui BPH, Lee AM, Macfarlane DJ, Leung SSK, Cerin E, Chan WYY, Leung IPF, Lam SHS, Taylor AJ, Cheng K. Physical activity for cancer survivors: meta-analysis of randomised controlled trials. BMJ. 2012;344:e70. DOI: https://doi.org/10.1136/bmj.e70
4. Ammitzboll G, Søgaard K, Karlsen RV, Tjønneland A, Johansen C, Frederiksen K, Bidstrup P, Physical activity and survival in breast cancer. Eur J Cancer. 2016;66:67–74.
5. Campbell KL, Winters-Stone KM, Wiskemann J, May AM, Schwartz AL, Courneya KS, Zucker DS, Matthews CE, Ligibel JA, Gerber LH, Morris GS, Patel AV, Hue TF, Perna FM, Schmitz KH. Exercise guidelines for cancer survivors: consensus statement from international multidisciplinary roundtable. Med Sci Sports Exerc. 2019;51(11):2375–90.
6. Winters-Stone KM, Neil SE, Campbell KL. Attention to principles of exercise training: a review of exercise studies for survivors of cancers other than breast. Br J Sports Med. 2014; 48(12):987–95.
7. Campbell KL, Neil SE, Winters-Stone KM. Review of exercise studies in breast cancer survivors: attention to principles of exercise training. Br J Sports Med.2012;46(13):909–16.
8. Fairman CM, Nilsen TS, Newton RU, Taaffe DR, Spry N, Joseph D, Chambers SK, Robinson ZP, Hart NH, Zourdos MC, Focht BC, Peddle-McIntyre CJ, Galvão DA. Reporting of resistance training dose, adherence, and tolerance in exercise oncology. Med Sci Sports Exerc. 2020;52(2):315–22.
9. Neil-Sztramko SE, Winters-Stone KM, Bland KA, Campbell KL. Updated systematic review of exercise studies in breast cancer survivors: attention to the principles of exercise training. Br J Sports Med. 2019;53(8):504–12.
10. Segal R, Zwaal C, Green E, Tomasone JR, Loblaw A, Petrella T; Exercise for People with Cancer Guideline Development Group. Exercise for people with cancer: a systematic review. Curr Oncol. 2017;24(4):e290–315.
11. Covington KR, Hidde MC, Pergolotti M, Leach HJ. Community-based exercise programs for cancer survivors: a scoping review of practice-based evidence. Support Care Cancer. 2019;27(12):4435–50.
12. Sweegers MG, Altenburg TM, Chinapaw MJ, Kalter J, Verdonck-de Leeuw IM, Courneya KS, Newton RU, Aaronson NK, Jacobsen PB, Brug J, Buffart LM. Which exercise prescriptions improve quality of life and physical function in patients with cancer during and following treatment? A systematic review and meta-analysis of randomised controlled trials. Br J Sports Med. 2018;52(8):505–13.
13. Leach HJ, Covington KR, Voss C, LeBreton KA, Harden SM, Schuster SR. Effect of group dynamics-based exercise versus personal training in breast cancer survivors. Oncol Nurs Forum. 2019;46(2):185–97.
14. Leach HJ, Potter KB, Hidde MC. A group dynamics-based exercise intervention to improve physical activity maintenance in breast cancer survivors. J Phys Act Health. 2019;16(9): 785–91.
15. Dishman RK, Buckworth J. Increasing physical activity: a quantitative synthesis. Med Sci Sports Exerc. 1996;28(6): 706–19.
16. Pollock ML, Bohannon RL, Cooper KH, Ayres JJ, Ward A, White SR, Linnerud AC. A comparative analysis of four protocols for maximal treadmill stress testing. Am Heart J. 1976;.92(1):39–46.

17. Riebe D, Ehrman JK, Liguori G, Magal M. ACSM's guidelines for exercise testing and prescription. 10th ed. Philadelphia: Wolters Kluwer; 2018.
18. The IPAQ Group. International Physical Activity Questionnaire. https://sites.google.com/site/theipaq/home. Updated August 17, 2020. Accessed November 30, 2020.
19. Dos Santos WDN, Gentil P, de Moraes RF, Ferreira Júnior JB, Campos MH, de Lira CAB, Freitas Júnior R, Bottaro M, Vieira CA. Chronic effects of resistance training in breast cancer survivors. Biomed Res Int. 2017;2017:1–18.
20. Smoot B, Paul SM, Aouizerat BE, Dunn L, Elboim C, Schmidt B, Hamolsky D, Levine JD, Abrams G, Mastick J, Topp K, Miaskowski C. Predictors of altered upper extremity function during the first year after breast cancer treatment. Am J Phys Med Rehabil. 2016;95(9):639–55.
21. Neil-Sztramko SE, Kirkham AA, Hung SH, Niksirat N, Nishikawa K, Campbell KL Aerobic capacity and upper limb strength are reduced in women diagnosed with breast cancer: a systematic review. J Physiother. 2014;60(4):189–200.