Effects of Exercise Intensity and Self-Efficacy on State Anxiety With Breast Cancer Survivors

Rachel Blacklock, MA, Ryan Rhodes, PhD, Chris Blanchard, PhD, and Catherine Gaul, PhD

Purpose/Objectives: To determine whether acute exercise reduces state anxiety and whether this reduction is moderated by the sample (i.e., breast cancer survivors versus those without a cancer diagnosis), exercise intensity (i.e., moderate versus light), and the potential sample times intensity interactions; and to explore whether changes in self-efficacy and state anxiety reciprocally predict each other as suggested by social cognitive theory.

Design: Repeated-measures, experimental pilot.

Setting: University laboratory.

Sample: Breast cancer survivors ($n = 25$) and age-matched women without a cancer diagnosis ($n = 25$).

Methods: Cycling for 20 minutes at light and moderate intensities on two separate occasions. State anxiety and self-efficacy measures were completed before, immediately following, and 10 minutes after exercise.

Main Research Variables: State anxiety, self-efficacy, and light and moderate exercise.

Findings: 2 (sample) x 2 (intensity condition) x 3 (time) repeated-measure analyses of variance revealed a main effect for time ($p < 0.01$, $\eta^2 = 0.37$, $F_{[2, 86]} = 24.687$), but between-sample and exercise intensity interaction effects were not significant. Autoregressive path analysis using ordinary least squares multiple regression revealed significant reciprocation for self-efficacy and anxiety pre-exercise (light intensity $\beta = 0.49$, $p < 0.05$; moderate intensity $\beta = -0.37$, $p < 0.05$) and post-exercise (moderate intensity $\beta = -0.31, -0.23$, $p < 0.05$).

Conclusions: Acute exercise at light and moderate intensity decreases state anxiety for breast cancer survivors and those without a diagnosis. Additional research is warranted.

Implications for Nursing: Light- and moderate-intensity exercise may be a valuable alternative anxiolytic tool that also allows for the acquisition of myriad additional known health benefits associated with exercise.

Anxiety, defined as an uneasy and unpleasant feeling of potential harm or distress that may occur in the absence of an obvious stimulus, often is reported in response to diagnosis and treatment of cancer (Newell, Sanson-Fisher, Girgis, & Ackland, 1999; Schwarz et al., 2008). In previous studies, breast cancer survivors have reported less control of their world and greater incidence of anxiety compared to age-matched women without a cancer diagnosis (Saleeba, Weitzner, & Meyers, 1996; Tomioch & Helgeson, 2002). Anxiety develops in association with cognitive processes relating to the inability to cope (Bottomley, 1998; Martens, Vealey, & Burton, 1990; Saleeba et al., 1996; Spencer et al., 1999; Stefanek, Derogatis, & Shaw, 1987).

Common anxiety-coping interventions include educational, informational, psychotherapeutic, and nonprofessional social support. These interventions report small effect sizes (d = 0.19–0.28), highlighting the need for more treatment alternatives (Meyer & Mark, 1995).

An alternative nonmedical option that is gaining empirical support for coping with anxiety is exercise (Knapen et al., 2008; Tekin, 2002). With breast cancer survivors, the effect of habitual exercise also has been reported to decrease state anxiety (Segar et al., 1998). To date, only one study has examined the anxiolytic effects of acute exercise with breast cancer survivors (Blanchard, Courneya, & Laing, 2001). This study reported findings consistent with the previous literature regarding a one-time bout of exercise in the general population and reported a substantial effect size (d = 0.7) (Callaghan, 2004; Focht, 2002; Motl & Dishman, 2004; Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991). The anxiolytic effect of exercise may be important for cancer survivors as well as the general population; however, initial pilot work is required to warrant larger future studies in this area, examining potential exercise intensity effects and possible psychological explanations for the anxiety-exercise relationship.

A comparison of acute exercise intensity effects on state anxiety with breast cancer survivors and those without a cancer diagnosis will confirm whether additional work regarding exercise prescription at a specified intensity is required for optimal anxiolytic effects. Comparisons of special or diseased populations and the general population have been advocated so that differences or similarities in exercise-related psychology can be observed (Rhodes & Blanchard, 2007). Considering the population involved in the present study, comparing light and moderate intensities may provide preliminary practical information for exercise prescription.

Finally, understanding the mechanism underlying the exercise-anxiety relationship may be important for promotion efforts (Ekkekasis, 2003). The mediating interaction between self-efficacy and the exercise-anxiety relationship, as described by the social cognitive theory (SCT) (Bandura, 1986), has been supported in previous literature as an underlying psychological exercise-anxiety mechanism (Butki, Rudolph, & Jacobsen, 2001; Katula, Blissmer, & McAuley, 1999; Marquez, Jerome, McAuley, Snook, & Canaklisova, 2002). SCT describes how an individual's behavior, cognition, and environment all interact reciprocally to predict and explain behavior. The foundation of SCT is self-efficacy. Concerning physical activity, exercise self-efficacy refers to one's beliefs about the capability to successfully engage in incremental bouts of physical activity. Self-efficacy influences a person's exercise behavior reciprocally such that a stronger sense of exercise self-efficacy results in a more favorable response to exercise, and these favorable responses serve to further boost self-efficacy (Bandura, 1997). In addition, the optimal exercise intensity for boosting self-efficacy occurs at levels that are optimally challenging. The mediating role that self-efficacy may play in the anxiety-exercise relationship has yet to be studied with cancer populations and will provide a foundation for possible future work in this area.

The purpose of this pilot study is, therefore, to determine whether acute exercise reduces state anxiety and whether this reduction is moderated by the sample (i.e., breast cancer survivors versus those without a cancer diagnosis), exercise intensity (i.e., moderate versus light), and the potential sample x intensity interactions; and to explore whether changes in self-efficacy and state anxiety reciprocally predict each other as suggested by the SCT.

No structured hypothesis exists for anxiety reductions across conditions. However, the greatest anxiolytic effects may potentially favor breast cancer survivors and the moderate-intensity exercise bout. For changes in self-efficacy and state anxiety, support for reciprocal determinism is hypothesized through the theoretical framework provided.

Methods

Participants

A total sample of 50 subjects, half being breast cancer survivors, were recruited from the Victoria, Canada, area. Table 1 displays demographic information for breast cancer survivors and those without a cancer diagnosis. The mean age of the breast cancer survivors and those without a diagnosis was 59 and 56 years, respectively. In general, the sample was well educated, with 40% having a bachelor's degree. More than 70% had an annual income of more than $40,000, and about 80% were married or living with a partner. Physical activity levels were just above the provincial average (64%), with more than 66% meeting the recommended guidelines set by the American College of Sports Medicine (1998) for weekly physical activity (Canadian Fitness and Lifestyle Research Institute, 2002). Pearson chi-square analysis showed no significant differences between groups with the exception of a difference calculated for annual income per year of less than $20,000. For breast cancer survivors, the average time from diagnosis was five years.

Procedure

Recruitment: Following approval from the university ethics board, recruitment posters were displayed at local breast cancer support centers, community centers, recreation centers, and hospitals. Interested participants were asked to contact the primary investigator to be screened for eligibility and receive a research package. The research package included information regarding the study, a participant consent form, a medical clearance form requiring a physician's signature to participate in two acute exercise bouts, a Physical Activity Readiness Questionnaire (PAR-Q) (Canadian Society for Exercise Physiology, 1994), and a participant profile questionnaire including demographic and medical variables. Breast cancer survivors sought approval to participate in the study from their general practitioners. Criterion sampling was used to select eligible participants. Participants had to be older than 18 years and be physically able to engage in light- to moderate-intensity exercise sessions as confirmed by a doctor or the PAR-Q (Canadian Society for Exercise Physiology, 1994). Breast cancer survivors were those who had previously received a breast cancer

Table 1. Descriptives for Breast Cancer Survivors Versus Those Without a Cancer Diagnosis

Characteristic	Cancer Survivors (N = 25) n	Cancer Survivors (N = 25) %	Without Diagnosis (N = 25) n	Without Diagnosis (N = 25) %
Race				
Caucasian	24	96	24	96
Other	1	4	1	4
Education				
Diploma from university	15	60	15	60
Bachelor degree	10	40	10	40
Annual income ($)				
Less than 20,000	2	8	4	16
20,001–40,000	3	12	3	12
More than 40,000	20	80	18	72
Marital status				
Never married	–	–	–	–
Widowed	2	8	2	8
Separated or divorced	3	12	3	12
Living with a partner	5	20	4	16
Married	15	60	16	64

Note. Cancer survivors had a $\bar{X}$ age of 59 years and an SD of 11.3; those without diagnosis had a $\bar{X}$ age of 56 years with an SD of 14.9.

diagnosis and had since completed treatment. Breast cancer survivors and participants without a cancer diagnosis were aged-matched ($p > 0.05$). No potential conflicts of interest concerning those involved in the study exist.

Pretest: On arrival at the laboratory, participants were randomly assigned to a light- or moderate-intensity condition, fitted with a heart rate monitor, and familiarized with the Borg Rating of Perceived Exertion (RPE) scale (Borg, 1998). Each participant was asked to complete both moderate- and light-intensity exercise conditions on two separate days. The order of conditions was counter-balanced, allowing for the comparison between conditions to focus on the intensity of exercise. Individuals served as their own controls.

A resting heart rate was taken after five minutes of seated rest. From the resting heart rate value, Karvonen's Heart Rate Reserve (HRR) and target heart rate range were calculated to define the intensity each individual participant must stay within during a bout of exercise (Heyward, 2002). The exercise sessions were performed by cycling on Monark ergometers that were fitted for each participant to ensure optimal performance. A five-minute warm-up pedaling at 60 revolutions per minute (rpm) was implemented prior to test start. Participants were informed of the heart rate range they would be expected to maintain for the exercise session during the five-minute warm-up. The State Anxiety Inventory (SAI) and Self-Efficacy Questionnaire (SEQ) for either light- or moderate-intensity exercise was completed prior to the exercise test (pre-exercise).

Test: Participants cycled for 20 minutes, maintaining a cadence of 60 rpm, and staying within the HRR range. The light-intensity group cycled at 30%–35% HRR, and the moderate-intensity group cycled at 60%–65% HRR (Heyward, 2002). Heart rate and RPE were recorded every two minutes during the test, and resistance was adjusted accordingly to maintain the designated heart rate range.

End of test: The SAI and SEQ were completed again immediately after exercise (post-exercise). Participants then cooled down at a preferred cadence for two minutes, dismounted the bike, and were asked to sit for eight minutes before completing the SAI and SEQ for a third time (after exercise). Heart rate was recorded at this time.

Instruments and Measures

Participant profile: Demographic and medical variables were assessed by self-report and consisted of age, ethnicity, marital status, education, employment, time since diagnosis, and date and types of treatments completed.

State anxiety: The 10-item SAI Y1 short form (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was used to assess state anxiety. Individuals were asked to rate their current feelings on a four-point scale ranging from 1 (not at all) to 4 (very much so). The items were summed to produce a total score in which higher scores are related to greater anxiety. The questionnaire asks how one is feeling right now. The Cronbach reliability coefficient across measurement time points was acceptable ($\alpha > 0.71$).

Self-efficacy: Self-efficacy was assessed with an adapted questionnaire from previous literature (Katula et al., 1999; Spielberger et al., 1983). The questionnaire asked participants to rate their beliefs in their physical capability to cycle incremental distances from 5–60 minutes at either light- or moderate-intensity. For each item, participants were asked to indicate their confidence on a 100-point percentage scale. This 100-point scale was comprised of 10-point increments, ranging from 0% (not at all confident) to 100% (highly confident). A total self-efficacy score was calculated by summing the confidence ratings and then dividing the summed ratings by the total number of items in the scale, resulting in a maximum possible efficacy score of 100. This measurement strategy is consistent with Bandura's guidelines for measuring self-efficacy and has been widely used in the physical activity literature (Bandura, 1997; Katula et al., 1999; McAuley, Talbot, & Martinez, 1998; Treasure & Newberry, 1998). The Cronbach reliability coefficient across measurement time points was acceptable ($\alpha > 0.91$).

Heart rate and ratings of perceived exertion: Heart rate was measured with a Polar® A3 heart rate monitor, and perceived exertion was measured with Borg's RPE scale (Borg, 1998), which required participants to rate, on a 15-point scale (from 6–20), their perceptions of exertion during exercise. The scale ranges in description from 7 (very, very light) to 19 (very, very hard). Literature surrounding the use of RPE scales to determine exercise intensities reports its criterion-validity as moderate ($r = 0.6$ for heart rate, VO_2 max, and VO_2) (Chen, Fan, & Moe, 2002).

Statistical Analysis

Main variable descriptive information is displayed in Table 1. Differences between cancer survivors and without diagnosis group for descriptive and dependent variables were tested with Pearson chi-square analysis and one-way analyses of variance (ANOVA).

ANOVA assumptions were checked by Mauchly's Test of Sphericity and Levene's Homogeneity Test of Variance. To confirm randomization of exercise intensity days, a 2 (day) x 3 (time) repeated-measures analysis of covariance (ANCOVA) for state anxiety and self-efficacy variables was calculated (Field, 2005; Glass & Hopkins, 1996).

To determine whether acute exercise reduces state anxiety and whether this reduction is moderated by sample (i.e., breast cancer survivors versus those without diagnosis), exercise intensity (i.e., moderate versus light), and potential sample x intensity interactions, a 2 (sample) x 2 (exercise intensity) x 3 (time) repeated-measures ANOVA was used. To examine whether changes in self-efficacy reciprocated the changes in state anxiety across exercise-intensity conditions, an autoregressive path analysis procedure with least squares multiple regression was completed (Gollob & Reichard, 1987, 1991).

Results

Dependent Variables

Table 2 shows mean scores and standard deviations for dependent variables of interest. Chi-square analyses showed no significant difference between groups. One-way ANOVA revealed no significant results between variables at baseline.

Mean Differences

Assumptions: For state anxiety, Mauchly's Test of Sphericity was violated for main effects ($\chi^2[2] = 10.5$, $p < 0.001$). Therefore, degrees of freedom were corrected with Huynh-Feldt Estimates of Sphericity ($\varepsilon = 0.87$) (Gollob & Reichard, 1987, 1991). Levene's Homogeneity Test of Variance was met ($p > 0.05$). For self-efficacy, Mauchly's test was violated for main effects ($\chi^2[2] = 29.7$, $p < 0.001$). Again, degrees of freedom were corrected with Huynh-Feldt Estimates of Sphericity ($\varepsilon = 0.67$) (Gollob & Reichard, 1987, 1991). Levene's Homogeneity Test of Variance was met ($p > 0.05$). Type one error was set at 0.01 to provide some experiment-wise error protection. Repeated-measures ANCOVA confirmed no significant differences between day 1 and day 2 for state anxiety and self-efficacy variables ($p > 0.05$).

State anxiety: Repeated-measures ANOVA revealed a main effect for time ($p < 0.01$, $\eta^2 = 0.37$, $F_{[2, 86]} = 24.687$), illustrating anxiety decreased across the exercise bout. Exercise intensity interaction effects were not significant ($p > 0.01$), indicating the changes in anxiety across time were not different for a particular exercise intensity condition. Between-group analyses also were not significant ($p > 0.05$), suggesting no difference between the cancer survivor and the without-diagnosis groups. Tukey's post hoc illustrates significant differences for pre- and post-after exercise ($p < 0.01$) (see Table 3). Cohen's effect size pre- to after exercise for cancer survivors and those without a diagnosis was d = 0.88, 0.71, 0.84, and 0.98 for light and moderate exercise conditions, respectively (Cohen, 1997).

Self-efficacy: Repeated-measures ANOVA showed a main effect for time ($p < 0.01$, $\eta^2 = 0.19$, $F_{[2, 82]} = 9.87$) but no interaction effects with exercise intensity or sample group ($p > 0.01$), illustrating self-efficacy increased over the exercise bouts, but no differences existed between exercise intensity conditions or cancer survivors versus those without a cancer diagnosis. Tukey's post hoc depicts significant differences pre-post and pre-after exercise ($p < 0.01$). Cohen's effect size pre-exercise to after exercise for cancer survivors and those without a diagnosis was d = 0.82, 0.71, 0.4, and 0.24 for light and moderate exercise conditions, respectively (Cohen, 1997).

Because no significant between-group effects existed, breast cancer survivors and without-diagnosis groups were collapsed for remaining analyses to improve power.

Table 2. State Anxiety and Self-Efficacy Scores for Breast Cancer Survivors and Those Without Cancer Before and After Exercise

Variable	Cancer Survivors (N = 25) $\bar{X}$	Cancer Survivors (N = 25) SD	Without Diagnosis (N = 25) $\bar{X}$	Without Diagnosis (N = 25) SD
State Anxiety				
Light exercise				
Pre-exercise	13.5	3.6	12.7	4.1
Post-exercise	13	3	12.7	2.9
After exercise	11.3	0.88	10.8	1
Moderate exercise				
Pre-exercise	15.1	4.3	15	4.2
Post-exercise	14.3	3.8	13.8	3.5
After exercise	12.1	2.6	11.8	2.1
Self-Efficacy				
Light exercise				
Pre-exercise	81.1	22.5	87.3	23.9
Post-exercise	89.6	14.9	91	16.9
After exercise	93.6	8.42	93.7	14.1
Moderate exercise				
Pre-exercise	74.6	22.1	84.1	22.5
Post-exercise	80.1	16.9	87.8	14.7
After exercise	82	16.2	88.5	17.1

Evaluation of Reciprocal Relationship Between Self-Efficacy and State Anxiety

Path analysis indicated significant reciprocation for anxiety and self-efficacy pre-exercise ($\beta = 0.49$, $p < 0.05$) for the light-intensity condition and pre-exercise ($\beta = -0.37$, $p < 0.05$), and post-exercise ($\beta = -0.31$, -0.23, $p < 0.05$) for the moderate-intensity condition (see Figures 1 and 2).

Discussion

This study piloted the anxiolytic effects of acute exercise by comparing breast cancer survivors and those without a cancer diagnosis, light- and moderate-intensity exercise, and a theoretical mechanism that purportedly mediates the relationship. Results generally support the authors' hypothesis that acute exercise would decrease state anxiety levels for breast cancer survivors and those without a cancer diagnosis and supports additional investigation in this area. The main effects of exercise on state anxiety reduction were large (Cohen, 1997). This result is similar to that found by Blanchard et al.

Table 3. Post-Hoc Analysis for State Anxiety and Self-Efficacy

Variable	Pre-Exercise (N = 50)	Post-Exercise (N = 50)	After Exercise (N = 50)	F	η^2
State Anxiety					
Light exercise*	13.3	12.8	11.3	10.1	0.18
Post hoc	–	–	–	–	–
Pre-post exercise	–	–	–	–	–
Post-after exercise*	–	–	–	–	–
Pre-after exercise*	–	–	–	–	–
Moderate exercise*	15.15	14.04	12.08	22.4	0.32
Post hoc	–	–	–	–	–
Pre-post exercise	–	–	–	–	–
Post-after exercise*	–	–	–	–	–
Pre-after exercise*	–	–	–	–	–
Self-Efficacy					
Light exercise*	87.5	92.6	93.6	9.82	0.19
Post hoc	–	–	–	–	–
Pre-post exercise*	–	–	–	–	–
Post-after exercise	–	–	–	–	–
Pre-after exercise*	–	–	–	–	–
Moderate exercise*	79.3	83.9	85.3	4.86	0.1
Post hoc	–	–	–	–	–
Pre-post exercise*	–	–	–	–	–
Post-after exercise	–	–	–	–	–
Pre-after exercise*	–	–	–	–	–

* $p < 0.01$

(2001), who reported a moderate to large effect size and suggested considerable clinical meaningfulness. However, it was thought that breast cancer survivors might experience a larger decrease in anxiety over the exercise condition compared to those without a cancer diagnosis, but this was not supported. Another novel finding is that breast cancer survivors and those without a cancer diagnosis reported similar pre-exercise anxiety levels and reacted identically to acute exercise. Perhaps demographic and psychological variables have more of an influence over pre-exercise state anxiety levels and pre-post exercise state anxiety changes than does a cancer diagnosis (Ekkekasis, 2003; Rothrock, Matthews, Sellergren, Fleming, & List, 2005). Psychological illness, disease, other cancers, and multiple cancer recurrence were not controlled, which could have influenced results and, therefore, must be considered when interpreting findings. In addition, the length of time from diagnosis may have attenuated the state anxiety levels expected for breast cancer survivors (Newell et al., 1999; Schwarz et al., 2008).

Other findings concern the intensities of exercise conditions. Greater reductions in anxiety are expected for optimally challenging intensity conditions (Ekkekakis & Petruzzello, 1999). This study showed moderate to large effects with conservative exercise intensities in a population that scored within normal ranges of pre-exercise state anxiety for those aged 55–59 years (Spielberger et al., 1983). In addition, the hypothesized difference in state anxiety between exercise intensity conditions was not supported in the present study. According to Bandura's SCT, this finding suggests that both intensity levels were challenging enough for participants to increase self-efficacy, thereby decreasing state anxiety (Bandura, 1997).

Two other studies have reported no significant differences in anxiety reductions between light- and moderate-intensity exercises ($p > 0.05$) (Katula et al., 1999; Raglin & Wilson, 1996). The findings demonstrate the magnitude of impact exercise may have on state anxiety. They also support the difference in intensity required for psychological versus physiologic benefits from exercise (Warburton, Katzmarzyk, Rhodes, & Shephard, 2007).

Finally, the results showed some support for self-efficacy and state anxiety reciprocation as described by

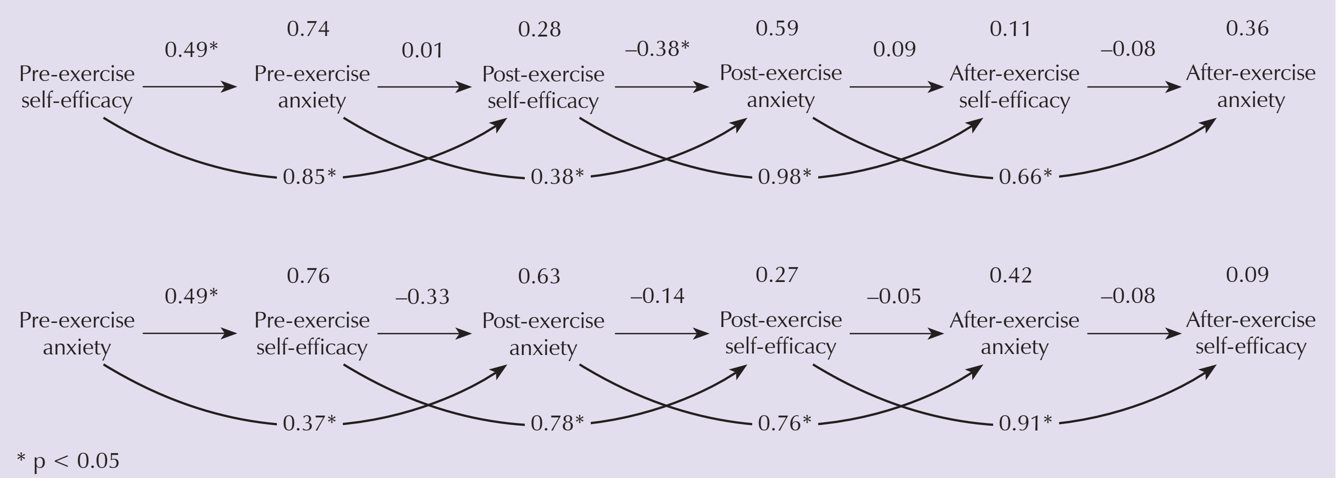

Figure 1. Reciprocation of Self-Efficacy and State Anxiety Across Light-Intensity Acute Exercise

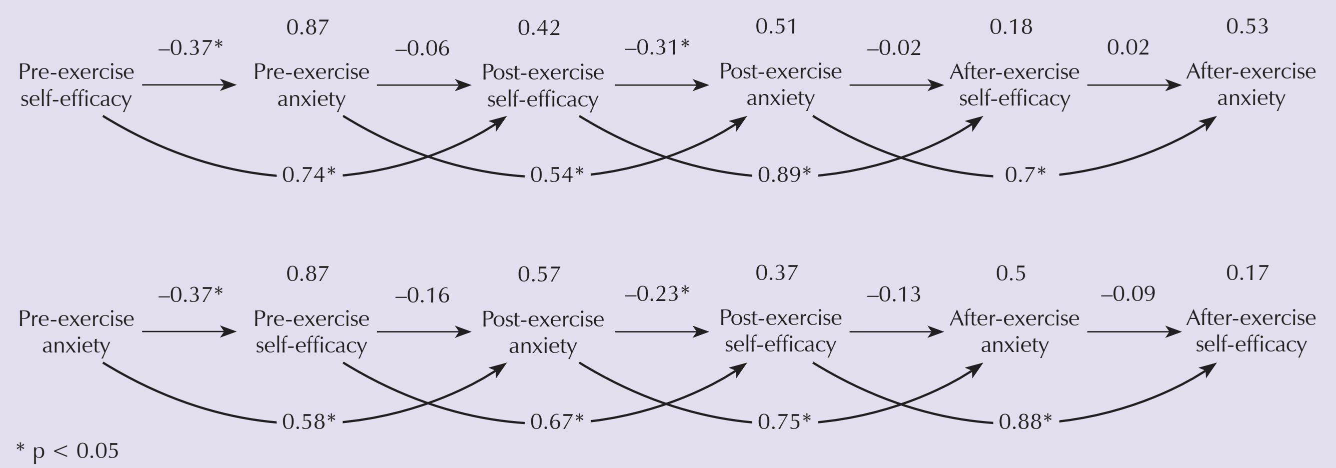

Figure 2. Reciprocation of Self-Efficacy and State Anxiety Across Moderate-Intensity Acute Exercise

the SCT (Butki et al., 2001; Marquez et al., 2002). The lack of complete reciprocation could be attributed to ceiling and floor effects of self-efficacy and state anxiety, respectively, which likely contributed to fewer than expected significant results. The path analyses showed a reciprocal relationship between state anxiety and self-efficacy for the pre-exercise time frame for both intensity conditions and the post-exercise time frame for the moderate condition only. Mastery experience appears to warrant additional investigation as a source of self-efficacy that increased across the exercise bout and transferred back into the observed reduction in state anxiety (Bandura, 1997). However, caution must be taken when interpreting these results. The authors are uncertain as to whether the observed effects occurred because of mastery of the exercise bout. A change in state anxiety also could be the effect of time or participant feelings of mastery over the completed testing session. Support for the observed increase in self-efficacy caused by mastery of the exercise session includes variability across participants in levels of self-efficacy and state anxiety change, results following the pattern predicted by SCT, and the change in self-efficacy measured by an exercise-specific scale.

Limitations

The repeated use of the SAI and SEQ questionnaires may have posed some test burden on respondents; however, participants were never explicitly told the hypotheses or dependent variables of interest and did not know the intensity of exercise until warm-up at the laboratory for each session. In addition, the anxiolytic effects reported for two bouts of exercise may not generalize to regular physical activity. However, the negative relationship reported between physical activity and exercise suggests that this notion is likely (Segar et al., 1998). Also, a study involving exercise inherently attracts physical activity advocates, possibly biasing the results toward activity and perhaps contributing to the proposed ceiling effect in exercise self-efficacy. Despite the self-reported mood state with which participants began the experiment, in general, they left with low levels of state anxiety and high levels of self-efficacy. Perhaps a study involving participants who may be experiencing higher levels of anxiety, such as cancer survivors undergoing treatment, or less fit individuals who are less confident in their physical activity abilities, would yield more significant effects (Focht, 2002; Landers & Petruzzello, 1996).

Conclusion

Exercise at moderate and light intensities may provide another strategy for reducing state anxiety with breast cancer survivors and women without a cancer diagnosis; however, additional research in this area is needed. Self-efficacy and the SCT may be useful for predicting changes in state anxiety. Future research in this area should focus on longer exercise interventions and cancer survivors or other subpopulations known to possess high levels of anxiety or poor exercise self-efficacy.

Rachel Blacklock, MA, is a research coordinator in Human Performance Research and Development at the Department of National Defence in Victoria; Ryan Rhodes, PhD, is an associate professor in the School of Exercise Science, Health, and Physical Education at the University of Victoria; Chris Blanchard, PhD, is an associate professor in the Faculty of Medicine at the Dalhousie University in Halifax; and Catherine Gaul, PhD, is an associate professor in the School of Exercise Science, Health, and Physical Education at the University of Victoria, all in Canada. No financial relationships to disclose. Mention of specific products and opinions related to those products do not indicate or imply endorsement by the *Oncology Nursing Forum* or the Oncology Nursing Society. Blacklock can be reached at rachelb@uvic.ca, with copy to editor at ONFEditor@ons.org. (Submitted December 2008. Accepted for publication May 25, 2009.)

Digital Object Identifier: 10.1188/10.ONF.206-212

References

American College of Sports Medicine. (1998). The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness and flexibility in healthy adults. *Medicine and Science in Sports and Exercise, 30,* 975–991. doi: 10.1097/00005768-199806000-00032

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman.

Blanchard, C.M., Courneya, K.S., & Laing, D. (2001). Effects of acute exercise on state anxiety in breast cancer survivors. *Oncology Nursing Forum, 28,* 1617–1621. doi: 10.1188/01.1617-1621

Borg, G. (1998). *Borg's perceived exertion and pain scales*. Champaign, IL: Human Kinetics.

Bottomley, A. (1998). Anxiety and the adult cancer patient. *European Journal of Cancer Care, 7,* 217–224.

Butki, B.D., Rudolph, D.L., & Jacobsen, H. (2001). Self-efficacy, state anxiety, and cortisol responses to treadmill running. *Perceptual Motor Skills, 92,* 1129–1138. doi: 10.2466/PMS.92.4.1129-1138

Callaghan, P. (2004). Exercise: A neglected intervention in mental health care? *Journal of Psychiatric and Mental Health Nursing, 11,* 476–483. doi: 10.1111/j.1365-2850.2004.00751.x

Canadian Fitness and Lifestyle Research Institute. (2002). Physical activity monitor. Retrieved from http://cflri.ca/cflri/pa/surveys/2002survey/2002survey.html

Canadian Society for Exercise Physiology. (1994). *PAR-Q and you*. Gloucester, Canada: Health Canada.

Chen, M.J., Fan, X., & Moe, S.T. (2002). Criterion-related validity of the Borg Ratings of Perceived Exertion scale in healthy individuals: A meta-analysis. *Journal of Sports Sciences, 20,* 873–899. doi: 10.1080/026404102320761787

Cohen, J. (1997). *Statistical power analysis for the behavioral sciences* (Revised ed.). New York, NY: Academic Press.

Ekkekakis, P. (2003). Pleasure and displeasure from the body: Perspectives from exercise. *Cognition and Emotion, 17,* 213–239.

Ekkekakis, P., & Petruzzello, S.T. (1999). Acute aerobic exercise and affect. *Sports Medicine, 28,* 337–374. doi: 10.2165/00007256-199928050-00005

Field, A. (2005). *Discovering statistics using SPSS* (2nd ed.). Thousand Oaks, CA: Sage.

Focht, B.C. (2002). Pre-exercise anxiety and the anxiolytic responses to acute bouts of self-selected and prescribed intensity resistance exercises. *Journal of Sports Medicine and Physical Fitness, 42,* 217–223.

Glass, G.V., & Hopkins, K.D. (1996). *Statistical methods in education and psychology* (3rd ed.). Needham Heights, MA: Allyn and Bacon.

Gollob, H.F., & Reichard, C.S. (1987). Taking account of time lags in causal models. *Child Development, 58,* 80–92.

Gollob, H.F., & Reichard, C.S. (1991). Interpreting and estimating indirect effects assuming time lags really mater. In L.M. Collins & J.L. Horn (Eds.), *Best methods for analysis of change* (pp. 243–259). Washington, DC: American Psychological Association.

Heyward, V.H. (2002). *Advanced fitness assessment and exercise prescription* (4th ed.). Champaign, IL: Human Kinetics.

Katula, J.A., Blissmer, B.J., & McAuley, E. (1999). Exercise intensity and self-efficacy effects on anxiety reduction in healthy, older adults. *Journal of Behavioral Medicine, 22,* 233–247. Retrieved from http://www.springerlink.com/index/M2M47KW2V1R2Q13X.pdf

Knapen, J., Sommerijns, E., Vancompfort, D., Sienaert, P., Pieters, G., Haake, P., . . . Peuskens, J. (2008). State anxiety and subjective well-being responses to acute bouts of aerobic exercise in patients with depressive and anxiety disorders. *British Journal of Sports Medicine, 43,* 756–759. doi: 10.1136/bjsm.2008.052654

Landers, D.M., & Petruzzello, S.J. (1996). Physical activity, fitness, and anxiety. In C.B. Bouchard, R.J. Shepard, & T. Stephens (Eds.), *Physical activity, fitness, and health: International proceedings and consensus statement* (pp. 868–882). Champaign, IL: Human Kinetics.

Marquez, D.X., Jerome, G.J., McAuley, E., Snook, E.M., & Canaklisova, S. (2002). Self-efficacy manipulation and state anxiety responses to exercise in low active women. *Psychology and Health, 17,* 783–791. doi: 10.1080/0887044021000054782

Martens, R., Vealey, R.S., & Burton, D. (1990). *Competitive anxiety in sports*. Champaign, IL: Human Kinetics.

McAuley, E., Talbot, H.M., & Martinez, S. (1998). Manipulating self-efficacy in the exercise environment in women: Influences on affective responses. *Health Psychology, 18,* 288–294. doi: 10.1037/0278-6133.18.3.288

Meyer, T., & Mark, M. (1995). Effects of psychosocial interventions with adult cancer patients: A meta-analysis of randomized experiments. *Health Psychology, 14,* 101–108. doi: 10.1037/0278-6133.14.2.101

Motl, R.W., & Dishman, R.K. (2004). Effects of acute exercise on the soleus H-reflex and self-reported anxiety after caffeine ingestion. *Physiology and Behavior, 80,* 577–585. doi: 10.1016/j.physbeh.2003.10.015

Newell, S., Sanson-Fisher, W., Girgis, A., & Ackland, S. (1999). The physical and psychosocial experiences of patients attending an outpatient medical oncology department: A cross-sectional study. *European Journal of Cancer Care, 8,* 73–82.

Petruzzello, S.J., Landers, D.M., Hatfield, B.D., Kubitz, K.A., & Salazar, W. (1991). A meta-analysis on the anxiety-reducing effects of acute and chronic exercise. *Sports Medicine, 11,* 143–182.

Raglin, J.S., & Wilson, M. (1996). State anxiety following 20 minutes of bicycle ergometer exercise at selected intensities. *International Journal of Sports Medicine, 17,* 467–471. doi: 10.1055/s-2007-972880

Rhodes, R.E., & Blanchard, C.M. (2007). Just how special are the physical activity cognitions in diseased populations? Preliminary evidence for integrated content in chronic disease prevention. *Annals of Behavioral Medicine, 33,* 302–312. doi: 10.1007/BF02879912

Rothrock, N.E., Matthews, A.K., Sellergren, S.A., Fleming, G., & List, M. (2005). State anxiety and cancer-specific anxiety in survivors of breast cancer. *Journal of Psychosocial Oncology, 24,* 93–109. doi: 10.1300/J077v22n04_06

Saleeba, A.K., Weitzner, M.A., & Meyers, C.A. (1996). Subclinical psychological distress in long-term survivors of breast cancer: A preliminary communication. *Journal of Psychosocial Oncology, 14,* 83–93. Retrieved from http://cat.inist.fr/?aModele=afficheN&cpsidt=2781526

Schwarz, R., Krauss, O., Hockel, M., Meyer, A., Zenger, M., & Hinz, A. (2008). The course of anxiety and depression in patients with breast cancer and gynecological cancer. *Breast Care, 3,* 417–422. doi: 10.1159/000177654

Segar, M., Katch, V.L., Roth, R.S., Garcia, A.W., Portner, T.I., & Glickman, S.G., . . . Wilkins, E.G. (1998). The effect of aerobic exercise on self-esteem and depressive and anxiety symptoms among breast cancer survivors. *Oncology Nursing Forum, 25,* 107–113.

Spencer, S.M., Lehman, J.M., Wynings, C., Arena, P., Carver, C.S., Antoni, M.H., . . . Love, N. (1999). Concerns about breast cancer and relationships to psychological well-being in a multiethnic sample of early-stage patients. *Health Psychology, 18,* 159–168.

Spielberger, C., Gorsuch, R., Lushene, R., Vagg, P., & Jacobs, G. (1983). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Stefanek, M.E., Derogatis, L.P., & Shaw, A. (1987). Psychological distress among oncology outpatients. *Psychosomatics, 28,* 530–539. Retrieved from http://psy.psychiatryonline.org/cgi/content/abstract/28/10/530

Tekin, A. (2002). The effects of physical exercise on anxiety. *Sports Journal, 5*(2), 7–21.

Tomioch, P., & Helgeson, V. (2002). Five years later: A cross-sectional comparison of breast cancer survivors with healthy women. *Psycho-Oncology, 11,* 154–169. doi: 10.1002/pon.570

Treasure, D.C., & Newberry, D.M. (1998). Relationship between self-efficacy, exercise intensity, and feeling states in a sedentary population. *Journal of Sport and Exercise Psychology, 20,* 1–11.

Warburton, D.E.R., Katzmarzyk, P., Rhodes, R.E., & Shephard, R. (2007). Evidence informed physical activity guidelines for Canadian adults. *Applied Physiology, Nutrition, and Metabolism, 32*(Suppl.), S16–S68. doi: 10.1139/H07-123