



Acute exercise effects on worry, state anxiety, and feelings of energy and fatigue among young women with probable Generalized Anxiety Disorder: A pilot study



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ABSTRACT

Background: Little is known about the acute effects of exercise among individuals with clinical or sub-clinical Generalized Anxiety Disorder (GAD).

Purpose: Thus, this study examined worry, state anxiety, and feelings of energy and fatigue responses to acute aerobic exercise and quiet rest, and explored potential moderators of response among young adult women with worry scores indicative of GAD.

Methods: Seventeen young women with Penn State Worry Questionnaire scores ≥ 45 (60 ± 8) completed 30-min treadmill running at 65%–85% heart rate reserve (%HRR) and 30-min seated quiet rest in counterbalanced order. Outcomes included worry, state anxiety, and feelings of energy and fatigue. Two condition X two time repeated measures ANOVA examined differences across condition and time. Hedges' *d* effect sizes (95%CI) were calculated to quantify and compare the magnitude of change. Independent-samples *t*-tests explored potential moderators of outcome response.

Results: Total exercise time was 35.8 ± 3.4 min with a mean 30.3 ± 0.16 in-zone minutes (65%–85%HRR); participants exercised at $\sim 72.9 \pm 0.03$ %HRR (range 66%–79%). Compared with quiet rest, acute exercise significantly improved worry engagement, state anxiety, and feelings of energy and fatigue (all $p \leq 0.031$). Moderate-to-large ($d = 0.44$ to 1.69) reductions in state anxiety and feelings of fatigue and improvements in feelings of energy were found. Exercise-induced reductions in worry engagement were significantly larger among non-high trait anxious participants. Compared to normal sleepers, quiet rest significantly increased feelings of fatigue among poor sleepers.

Conclusion: Findings provide support for the positive effects of acute aerobic exercise on worry, state anxiety, and feelings of energy and fatigue among young women with worry indicative of GAD.

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1. Introduction

Among young adult women with Generalized Anxiety Disorder (GAD), evidence supports the effects of exercise training on clinical severity (Herring, Jacob, Suveg, Dishman, & O'Connor, 2012), worry, anxiety, and feelings of energy and fatigue, (Herring, Jacob, Suveg, & O'Connor, 2011), dimensions of sleep quality and quantity (Herring, Kline, & O'Connor, 2015), and health-related quality of life

(Herring, Johnson, & O'Connor, 2016). Improved signs and symptoms of GAD, including anxiety, worry, and feelings of energy and fatigue, have been reported following as few as two weeks of exercise training involving the collective effects of three bouts of exercise (Herring et al., 2011). However, less is known about the effects of a single bout of exercise among individuals with GAD and, in particular, subclinical levels of GAD (i.e., elevated worry, the hallmark of GAD). Given that individuals who display elevated symptom scores are more likely to develop clinically significant psychopathology (Ruscio et al., 2007; Wolitzky-Taylor et al., 2014), investigating exercise effects on worry and other key outcomes in the symptom profile of GAD, including state anxiety and feelings of energy and fatigue, among individuals with emerging symptoms of

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GAD may be particularly important. However, the effects of a single bout of exercise among individuals with elevated worry scores indicative of GAD are not yet known.

GAD is more prevalent among women (Bandelow & Michaelis, 2015; Remes, Brayne, Linde, & Lafortune, 2016), and women have a higher likelihood of reporting GAD symptoms shown to be improved by exercise (i.e., fatigue, irritability, muscle tension, and somatic symptoms) (Herring et al., 2011; Steiner et al., 2005; Vesga-López et al., 2008). The limited available evidence of exercise effects among individuals with GAD has supported positive benefits for young women with GAD. Recent evidence also supported moderate-to-large reductions in feelings of fatigue, total mood disturbance, and state anxiety and increases in feelings of energy following acute exercise in young adult women (McDowell, Campbell, & Herring, 2016). Thus, the authors' reasoned that females with elevated worry indicative of GAD may be particularly likely to benefit from a single bout of vigorous intensity aerobic exercise.

Additionally, very little is known about potential moderators of response to acute exercise. Identifying predictors/correlates of outcome responses to acute exercise has implications for the future development of both acute and chronic exercise protocols. Thus, the objectives of this study were to: (1) test the effects of acute aerobic exercise compared to quiet rest on worry, state anxiety, and feelings of energy and fatigue, and, (2) explore potential moderators of response among young women with worry scores indicative of GAD. The authors hypothesized that, compared to quiet rest, an acute bout of aerobic exercise would significantly improve worry, state anxiety, and feelings of energy and fatigue among young women with worry indicative of GAD.

2. Methods

2.1. Design & participants

The study protocol was approved by the University's Research Ethics Board. Prior to participation, interested potential participants provided written informed consent and completed a medical history screening questionnaire that included the Physical Activity Readiness Questionnaire. Seventeen young adult women, aged 20.8 ± 1.4 y, were recruited from the university and surrounding populations as part of ongoing recruitment for a series of acute exercise studies. Of 85 consecutively recruited individuals, 53 were included in a previously reported study using the same standard protocols (McDowell et al., 2016), seven did not provide adequate data to be included in the previously published study or the study reported here, and 8 potentially eligible male participants were excluded based on the current focus on female participants with probable GAD. Based on power analysis performed with G*Power, the resulting sample size of 17 would provide >80% statistical power to detect differences in worry assuming a two-tailed $\alpha = 0.05$, a correlation between repeated measures of $r = 0.8$, and a moderate effect of exercise on worry ($f = 0.23$, $d = 0.46$) based on previous evidence (Herring et al., 2012; McDowell et al., 2016). Potential participants were screened based on the Penn State Worry Questionnaire (Meyer, Miller, Metzger, & Borkovec, 1990). Inclusion criteria were: (i) Penn State Worry Questionnaire (PSWQ) score ≥ 45 , which has demonstrated high sensitivity and specificity as a cut-score to identify individuals with elevated worry indicative of GAD (Behar, Alcaine, Zullig, & Borkovec, 2003); (ii) age 18–35y; (iii) no medical contraindication to safe participation in vigorous aerobic exercise; and, (iv) no current pregnancy or lactation. Potential participants who met inclusion criteria were randomized using random number generation (www.randomizer.org) to complete two conditions in counterbalanced order at approximately the

same time of day, with approximately 48 h between conditions: (i) 30-min of vigorous running on a treadmill, or (ii) 30-min seated quiet rest, a well-established control condition in studies of acute exercise and mood (Ensari, Greenlee, Motl, & Petruzzello, 2015; McDowell et al., 2016).

2.2. Baseline measures

Before testing on day 1, each participant completed electronic versions (www.surveymonkey.com) of a Seven Day Physical Activity Recall (Blair et al., 1985), the trait subscale of the State-Trait Anxiety Inventory, (STAI-Y2) (Spielberger, 1983), the Quick Inventory of Depressive Symptoms (QIDS) (Rush et al., 2003), and the Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Established cut-scores were used to classify high trait anxious status, depression status, and poor sleep status. STAI-Y2 scores >1 SD above the age-related norm (~ 50) indicated high trait anxious status (Speilberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). QIDS scores ≥ 6 indicated depression (Rush et al., 2003). PSQI scores >5 indicated poor sleep (Buysse, Reynolds III, Monk, Berman, & Kupfer, 1989).

2.3. Outcomes

Using laboratory desktop PCs, immediately before and 10 min following exercise or quiet rest participants completed electronic assessments (www.surveymonkey.com) of worry, state anxiety, and the intensity of feelings of energy and fatigue. This process required approximately 10–15 min for participants.

2.3.1. Worry

Worry was assessed using the 16-item PSWQ (Meyer et al., 1990). Each participant rated 16 statements using a 5-item Likert scale from 1 "Not at all typical of me" to 5 "Very typical of me;" item responses are summed after reverse scoring such that total score ranges from 16 to 80. Worry engagement (11 items worded in the direction of pathological worry) and absence of worry (5 items reverse-worded to combat acquiescence) subscales were also calculated and examined (Fresco, Heimberg, Mennin, & Turk, 2002; Meyer et al., 1990). The PSWQ demonstrated adequate internal consistency in the current sample ($\alpha = 0.86$), and correlations between repeated measures were $r = 0.90$ and $r = 0.93$ for exercise and quiet rest, respectively. Worry engagement demonstrated similar internal consistency ($\alpha = 0.83$), and correlations between repeated measures were $r = 0.97$ and $r = 0.87$ for exercise and quiet rest, respectively. However, internal consistency for absence of worry was poor ($\alpha = 0.44$), and correlations between repeated measures were low for both exercise ($r = 0.40$) and quiet rest ($r = 0.49$). Recent evidence has suggested that the PSWQ is sensitive to change in response to acute aerobic exercise (McDowell et al., 2016).

2.3.2. State anxiety

State anxiety, conceptualized as transient, fluctuating feelings of tension and apprehension, was measured with the 20-item state subscale of the State-Trait Anxiety Inventory (STAI-Y1) (Spielberger et al., 1983). Participants rated each item using a 4-item Likert scale from 1 "Not at all" to 4 "Very much so;" item responses are summed after reverse scoring such that total score ranges from 20 to 80. The STAI-Y1 demonstrated adequate internal consistency in the current sample ($\alpha = 0.90$), and correlations between repeated measures were $r = 0.91$ and $r = 0.86$ for exercise and control, respectively.

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