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The role of physical activity enjoyment on the acute mood experience of exercise among smokers with elevated depressive symptoms



Ana M. Abrantes, Ph.D. ^{a, b, *}, Samantha G. Farris, Ph.D. ^{a, b, c}, Sarah L. Garnaat, Ph.D. ^{a, b}, Alexia Minto, B.A. ^a, Richard A. Brown, Ph.D. ^{b, d}, Lawrence H. Price, M.D. ^{a, b}, Lisa A. Uebelacker, Ph.D. ^{a, b}

^a Butler Hospital, Providence, RI, USA

^b Alpert Medical School of Brown University, Providence, RI, USA

^c The Miriam Hospital, Providence, RI, USA

^d University of Texas at Austin, Austin, TX, USA

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ABSTRACT

Problem: Depressive symptoms are consistently shown to be related to poor smoking cessation outcomes. Aerobic exercise is a potential treatment augmentation that, given its antidepressant and mood enhancing effect, may bolster cessation outcomes for smokers with elevated depressive symptoms. Lower enjoyment of physical activity may inhibit the acute mood enhancing effects of aerobic exercise. The current study investigated the associations between depressive symptoms, physical activity enjoyment and the acute mood experience from exercise among low-active smokers with elevated depressive symptoms.

Method: Daily smokers with elevated depressive symptoms (N = 159; M_{age} = 45.1, SD = 10.79; 69.8% female) were recruited for a randomized controlled exercise-based smoking cessation trial. Participants self-reported levels of depressive symptoms, physical activity enjoyment, and rated their mood experience (assessed as "mood" and "anxiety") before and after a standardized aerobic exercise test.

Results: Hierarchical regression analysis revealed that depressive symptom severity accounted for significant unique variance in physical activity enjoyment ($R^2 = 0.041$, t = -2.61, p = 0.010), beyond the non-significant effects of gender and level of tobacco dependence. Additionally, physical activity enjoyment was a significant mediator of the association between depressive symptom severity and acute mood experience ("mood" and "anxiety") following the exercise test.

Conclusions: Physical activity enjoyment may explain, at least in part, how depressive symptom severity is linked to the acute mood experience following a bout of activity. Interventions that target increasing physical activity enjoyment may ultimately assist in enhancing the mood experience from exercise, and therefore improve smoking cessation likelihood, especially for smokers with elevated depressive symptoms.

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1. Introduction

Tobacco use continues to be the leading cause of preventable morbidity and mortality in the United States (U S Department of Health and Human Services, 2014). Relapse following a quit attempt is common – e.g., 70–85% who attend treatment programs

E-mail address: Ana_Abrantes@Brown.edu (A.M. Abrantes).

relapse within one year (Fiore et al., 2008). Smokers who are unable to quit are more likely to possess risk factors or characteristics that make it difficult to quit, such as psychiatric symptoms and disorders (Korhonen et al., 2011; Morrell, Cohen, & McChargue, 2010; Pratt & Brody, 2010; Trosclair & Dube, 2010). Robust evidence indicates that elevated depressive symptoms are related to the maintenance of smoking and cessation failure (Audrain-McGovern, Leventhal, & Strong, 2015; Mathew, Hogarth, Leventhal, Cook, & Hitsman, 2017). As a result, there has been growing interest in the development and testing of smoking cessation interventions that can effectively target depressive symptoms to help promote

^{*} Corresponding author. Butler Hospital, 345 Blackstone Blvd., Providence, RI 02906, USA.

smoking cessation (Weinberger, Mazure, Morlett, & McKee, 2013).

One such intervention is aerobic exercise. Aerobic exercise interventions have been tested as an adjunctive smoking cessation strategy (Ussher, Taylor, & Faulkner, 2014), although the effect of exercise on long-term smoking cessation has been mixed, likely due to small sample sizes and insufficient intervention intensity (Ussher et al., 2014). However, bouts of aerobic exercise appear to consistently result in medium-to-large sized acute effects on reduced cigarette craving and enhanced mood (Haasova et al., 2013; Roberts, Maddison, Simpson, Bullen, & Prapavessis, 2012; Ussher et al., 2014). Indeed, it has been argued that exercise as a cessation aid, given its antidepressant and mood enhancing effect (Carek, Laibstain, & Carek, 2011; Cooney et al., 2013; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005), may be particularly effective for smokers with elevated depressive symptoms (Bernard et al., 2013). Several preliminary studies with depressed smokers have found that aerobic exercise as an intervention may increase likelihood of smoking cessation outcomes (Bernard et al., 2012, 2015; Patten et al., 2017; Vickers et al., 2009). However, as is the case with the general population, adherence to exercise programs among smokers is low (Ussher et al., 2014). Understanding factors that influence adherence to exercise in smokers, particularly those who may be vulnerable to depression, is essential for increasing the efficacy of aerobic exercise as a smoking cessation strategy.

There is growing recognition that physical activity enjoyment is related to adherence to physical activity programs (Williams, 2008). Consistent with hedonic theory (Kahneman, Diener, & Schwarz, 1999), people are more likely to do what they find pleasurable, while avoiding behaviors that they do not enjoy. Thus, greater physical activity enjoyment is posited to result in increased behavioral intentions to exercise, and in turn, sustained engagement in physical activity (Phillips, Chamberland, Hekler, Abrams, & Eisenberg, 2016).

Indeed, data non-specific to smokers indicate that self-reported physical activity enjoyment is cross-sectionally positively correlated with level of physical activity engagement (Cleland et al., 2010; Hagberg, Lindahl, Nyberg, & Hellénius, 2009; Rech, Reis, Hino, & Hallal, 2014; Salmon, Owen, Crawford, Bauman, & Sallis, 2003; Umeda, Marino, Less, & Hilliard, 2014) and prospectively associated with greater exercise program adherence and long-term maintenance of physical activity (Crain, Martinson, Sherwood, & O'Connor, 2010; Dishman, Jackson, & Bray, 2014; Herens, Bakker, Van Ophem, Wagemakers, & Koelen, 2016; Lewis, Williams, Frayeh, & Marcus, 2016; Williams et al., 2006). Self-report of physical activity enjoyment also predicts acute increases in positive mood and decreases in negative mood from pre-to post-exercise (Miller, Bartholomew, & Springer, 2005; Motl, Berger, & Leuschen, 2000) and mediates the exercise-mood relationship (Miller et al., 2005; Motl et al., 2000). For example, Motl et al. (2000) compared the acute mood effects of engaging in a rock-climbing exercise versus health education class among 95 male adults and found that the mood benefits associated with the exercise condition were mediated by physical activity enjoyment. However, results have not always consistently found an association between physical activity enjoyment and acute changes in mood following aerobic exercise (Berger, Darby, Zhang, Owen, & Tobar, 2016, 2010).

Depressive symptoms, such as inability to experience pleasure (i.e., anhedonia), lack of motivation, negative affect, and cognitive distortions (e.g., all-or-none thinking), may interfere with an individual's ability to experience enjoyment from exercise. The two studies of which we are aware that have examined the association between physical activity enjoyment and depressive symptoms, both non-specific to smoking, have yielded inconsistent results. Among adults with functional limitations, depressive symptoms and physical activity enjoyment were not significantly related (Murrock, Bekhet, & Zauszniewski, 2016). In contrast, among college students, physical activity enjoyment mediated the association between anhedonia and lower physical activity levels (Leventhal, 2012). Given this limited examination of the relationship between depressive symptoms and physical activity enjoyment, it is important to continue to evaluate the nature of these associations, particularly among smokers, for whom exercise adherence is critical for successful cessation outcomes (Ussher et al., 2014).

Thus, the current study aimed to examine the associations between depressive symptom severity over the past two weeks, physical activity enjoyment, and the acute mood-enhancing effects of a bout of exercise among a sample of low-active daily smokers with elevated depressive symptoms who were seeking treatment for smoking cessation. First, we hypothesized that depressive symptom severity would be significantly and inversely related to physical activity enjoyment, beyond the effects of tobacco dependence and gender. Second, physical activity enjoyment was hypothesized to be a mediator (indirect predictor) of the association between depressive symptom severity and the acute moodenhancing effects of a bout of physical activity.

2. Method

2.1. Participants and procedure

Data analyzed were collected as part of an ongoing randomized controlled smoking cessation trial for community-recruited treatment-seeking smokers with elevated depressive symptoms (clinicaltrials.gov #:NCT02086149). Data included in this study were from smokers recruited from February 2014 to October 2016. The trial is examining the efficacy of standard telephone-based cognitive behavioral therapy (CBT) for smoking cessation and nicotine replacement therapy, with one of two adjunctive treatments: (a) 12-session, group aerobic exercise (AE) intervention or (b) 12-session, group health-education control (HEC) intervention. Interested participants were screened by telephone and invited for a baseline assessment on the basis of: being between the ages of 18–65 years, smoking \geq 10 cigarettes per day, and having elevated depression symptoms as evidenced by a score ≥ 6 on the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). Callers were excluded from participation during the telephone screen based on the following primary criteria: engaged in more than 90 min of moderate-to-vigorous physical activity for the last 12 weeks, physical disabilities or medical problems contraindicating aerobic exercise, current pregnancy or intention to become pregnant in the next 3 months, and current use of pharmacotherapy for smoking cessation (e.g., nicotine replacement therapy). Potentially eligible participants were scheduled for a baseline Day 1 appointment, during which depression, physical activity enjoyment, and tobacco dependence were assessed. Participants who did not meet DSM-IV criteria for alcohol or drug abuse or dependence, bipolar disorder, eating disorder, psychotic disorder, current suicidality or homicidality during the baseline assessment (baseline day 1), and for whom medical clearance to exercise was obtained from their primary care physician, were asked to attend a second baseline assessment (baseline day 2; approximately one week after baseline day 1). At that visit, cardiorespiratory fitness was determined through a 1-mile walk test. Pre-and post-walk test ratings of mood were collected. After, participants were randomized to AE or HE and informed of their treatment condition. Only pre-randomization (baseline) data were utilized in the current investigation. Participants who completed self-report assessments at baseline day 1 and the walk test at baseline day 2 (n = 159, $M_{age} = 45.1$, SD = 10.79; 69.8% female) were included in data analysis.

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