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Characterizing the affective responses to an acute bout of moderate-intensity exercise among outpatients with schizophrenia



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ABSTRACT

In addition to offering many physical health benefits, exercise may help improve mental health among individuals with schizophrenia through regulating affect. Therefore, the purpose of this study is to characterize affective responses experienced before, during and after a 10-min bout of exercise versus passive sitting among individuals with schizophrenia. A randomized crossover design compared affect related to feelings of pleasure and arousal at baseline, 6-min into the task, immediately post-task, and 10 min post-task to sitting. Thirty participants enrolled in the study; 28 participants completed the study. Separate mixed model analyses of variance were conducted for pleasure and arousal, with test order as the between-subject factor, and time and task as within-subject factors. For pleasure, a significant main effect for time and a time \times task interaction effect emerged. Post-hoc Bonferroni corrected t -tests ($\alpha = .0125$) revealed significant differences between pleasure at baseline and both immediately post-task and 10 min post-task. No other main effects or interactions emerged. Individuals with schizophrenia derive acute feelings of pleasure from exercise. Thus, exercise may provide a method of regulating affect to improve mental health. Future studies should examine the links between affective responses to health behaviours such as long-term adherence to exercise within this population.

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1. Introduction

Physical activity (PA), such as exercise, may provide multiple health benefits for persons with schizophrenia, such as reducing excess weight, improving glycemic control, and reducing the risk of cardiovascular disease (Scheewe et al., 2013; Stubbs et al., 2015). Several systematic reviews of randomized controlled trials have demonstrated that non-pharmacological interventions for managing weight – including PA – in individuals who have schizophrenia (Faulkner et al., 2007) or who are using antipsychotics (Caemmerer et al., 2012) are plausible and modestly efficacious. In addition to the physical health benefits of PA, systematic reviews and meta-analyses of randomized controlled trials demonstrated small but significant improvements in the mental health of patients with schizophrenia who participate in the assigned PA intervention (Gorczyński and Faulkner, 2010; Rosenbaum et al., 2014; Firth et al., 2015), suggesting that regular PA can not only help prevent and manage physical co-morbidities of schizophrenia, but also may improve psychological symptoms and well-

being. One potential psychological mechanism through which PA may improve mental health is by regulating affect.

In a series of papers, Ekkekakis and Petruzzello (2000, 2001a, 2001b, 2002) identify core affect, the fundamental and reflexive feelings of pleasure and arousal that are elicited by exposure to a stimulus, as the ideal target to assess general changes in affect in response to a single acute bout of PA. Specifically Ekkekakis and Petruzzello (2002) advocate for the use of the Circumplex Model of Affect (Russell, 1980; Fig. 1) when assessing core affect, given that it is a dimensional (comprising of pleasure and arousal) and highly parsimonious model, which matches the theorized structure of core affect. Since these recommendations were published, the affective responses to acute bouts of PA in the general population have been well characterized using the Circumplex Model of Affect. Using this model, researchers have shown within the general adult population that individuals tend to feel a greater increase in pleasure after engaging in lower intensity PA than more vigorous intensity PA (Reed and Ones, 2006; Ekkekakis et al., 2011a). During PA, feelings of pleasure tend to be homogeneously positive at low intensity, and homogeneously negative during more vigorous intensity PA, while at moderate intensities, feelings of pleasure vary considerably by individual, with roughly equal

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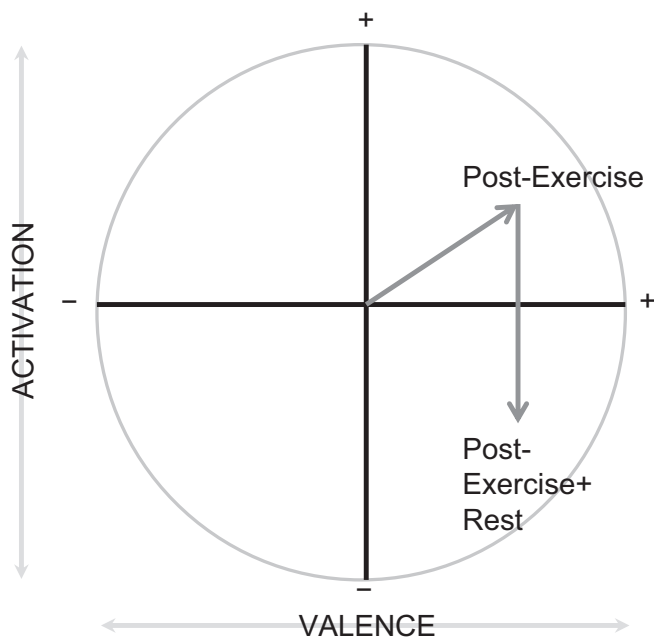


Fig. 1. Circumplex model of affect. Note: Arrows depict an approximation of the typical affective response after exercise based on Ekkekakis et al. (2011a).

proportions of participants reporting increases and decreases in pleasure (Ekkekakis et al., 2011a). Feelings of arousal increase during PA but decline over time after PA is ceased, while feelings of pleasure after PA remain elevated (Ekkekakis et al., 2011a).

Two studies have examined affective responses to PA among individuals with schizophrenia (Vancampfort et al., 2011; Heggelund et al., 2014); both have observed reductions in self-reported feelings of anxiety and psychological distress were reduced while positive well-being was increased immediately following 20 and 25 min bouts of exercise. However, neither of these studies have examined affect during exercise, which is a concern given that not all individuals may experience exercise as pleasurable in the moment, providing an inaccurate characterization of affect trajectory during exercise (Ekkekakis et al., 2011a) and that feelings during exercise may be related to motivation to continue with a bout of PA (Ekkekakis and Dafermos, 2012). Furthermore, only Heggelund et al. (2014) examined the effects of exercise on core affect using the Positive and Negative Affect Schedule (PANAS), finding an increase in positive activation after exercise. However, this study employed a high-intensity interval training protocol consisting of four 4 min bouts of vigorous intensity on a treadmill interspersed with 3 min moderate intensity breaks, which may not be the most feasible exercise for individuals who are unfamiliar with physical training to undertake on their own, or with minimal instruction.

Another pilot study has, however, used the Circumplex Model of Affect to examine affective responses, before, during, and after an acute bout of treadmill walking at a self-selected pace compared to sitting among 14 people with serious mental illness (three participants self-reported schizophrenia) as a secondary outcome, (Arbour-Nicitopoulos et al., 2011). The intensity of each task was assessed objectively using heart rate and subjectively with the Borg Ratings of Perceived Exertion (Borg RPE; Borg, 1998). The 10-min brisk walking induced a significantly higher mean heart rate and Borg RPE score than the sitting condition. Mean Borg RPE during the exercise condition was 9.99, with a range of 6–13.6, suggesting that although some participants had reached moderate-intensity thresholds (ratings from 12–14; Borg, 1998), participants generally perceived the PA as light-intensity. A significant time by condition interaction for pleasure was observed

($p < .05$, partial $\eta^2 = .19$), as well as a main effect for time along the arousal dimension ($p < .03$, partial $\eta^2 = .21$). Overall, this study demonstrated a trend for increases in activation and valence when participants engaged in brisk walking versus passive sitting. However, having a pre-set, objectively measured intensity level for the exercise condition may help to clarify these results, by reducing variation in the stimulus. Furthermore, using a sample comprised solely of people with schizophrenia will improve the specificity of the results.

Common national and international PA guidelines recommend adults engage in 150 min of moderate to vigorous intensity PA per week, in bouts of at least 10 min, in order to reduce the risk of disease (World Health Organization, 2010; Canadian Society of Exercise Physiology, 2012). Brisk walks of 10 min or more at a moderate-intensity, for example, can contribute to meeting these guidelines. Minimally intensive exercise in 10-min bouts may represent an achievable way for individuals with poor physical fitness to begin accruing health benefits from PA. Of note, a recent systematic review of walking interventions for people with schizophrenia (Soundy et al., 2014), suggests small improvements in health factors such as weight, body composition, and waist circumference, with no adverse events reported. Walking also requires minimal equipment and is feasible for most individuals without physical disabilities or other limitations. Brief bouts of walking at moderate-intensity may therefore be a simple and feasible way for individuals with schizophrenia to become physically active.

Therefore the purpose of the study is to characterize affect before, during, and after a 10-min bout of treadmill walking on affect among individuals with schizophrenia, compared to passive sitting. It was hypothesized that individuals with schizophrenia will demonstrate the typical pattern of increased arousal during exercise, followed by a decrease in arousal with time after exercise is ceased. Meanwhile, feelings of pleasure were hypothesized to increase after exercise and remain elevated. Affect is not expected to change during the sitting condition.

2. Methods

2.1. Participants

Study eligibility required participants to be: (1) age 18–64 years in line with Canadian Physical Activity Guidelines recommendations for adults (Canadian Society of Exercise Physiology, 2012); (2) outpatients with schizophrenia or schizoaffective disorder; and (3) deemed safe to engage in PA as assessed by the Physical Activity Readiness Questionnaire (Canadian Society for Exercise Physiology, 2002). Participants were deemed ineligible to participate if they had: (1) been hospitalized in the past 12 months for angina pectoris, myocardial infarction, or cardiac surgery of any kind; and/or (2) uncontrolled hypertension (defined as blood pressure $> 140/90$).

Participants were recruited from a larger, prospective study examining the determinants of physical activity among individuals with schizophrenia. All participants enrolling in the larger study were invited to participate in the present study. Research ethics approval for the present study was obtained from the University of Toronto. Participants provided written consent prior to commencing the study, and capacity to consent was assessed immediately after using the MacArthur Competence Assessment Tool for Clinical Research (MacCAT-CR; Appelbaum and Grisso, 2001)

Required sample size calculations were based on the between-within factors (task and time) interaction effect on pleasure was partial $\eta^2 = 0.19$ previously observed by Arbour-Nicitopoulos et al. (2011). Based on this effect size with an alpha level of 0.05 and

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