Journal of Affective Disorders 190 (2016) 467–473

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research report

Characterizing exercise-induced feelings after one bout of exercise among adolescents with and without bipolar disorder

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ARTICLE INFO

Article history:
Received 6 August 2015
Received in revised form
28 September 2015
Accepted 15 October 2015
Available online 28 October 2015

Keywords:
Bipolar disorder
Exercise-induced feelings
Mood management
Metabolic comorbidities

ABSTRACT

Background: Exercise may be a practical, non-pharmacological strategy for symptom and health management for adolescents with bipolar disorder (BD). The purpose of this study was to determine if adolescents with BD experience changes in exercise-induced feelings from one bout of exercise similar to their otherwise healthy peers.

Methods: Thirty-two adolescents with BD (Age (SD)=16.91 (1.4)) and 31 healthy adolescents (Age (SD)=15.68 (1.76)) completed the Exercise-Induced Feeling Inventory (EFI) before and after a 20-min bout of moderate intensity exercise (heart rate goal of 60–80% of the age estimated maximum [220 – 0.7*age]) on a cycle ergometer. Repeated-Measures ANCOVA was conducted on the four EFI subscales, controlling for age and BMI.

Results: There were no significant between-group differences on any subscales. An increase in Physical Exhaustion was of negligible effect size in both groups (BD: $d=0.05$; Control: $d=0.16$). There was an improvement in Revitalization (BD: $d=0.49$; Control: $d=0.61$) and a reduction in Tranquility (BD: $d=-0.33$; Control: $d=-0.29$) post-exercise of moderate and small effect size, respectively. The control group reported an increase in Positive Engagement that was of small-to-medium effect size, ($d=0.41$) with negligible change in the BD group ($d=0.17$). Healthy adolescents reported a significantly greater tolerance for high intensity exercise than adolescents with BD.

Limitations: Emotions were only assessed at two time points.

Conclusions: Adolescents with BD experience similar exercise-induced emotional benefits as their healthy peers. Experimental research is needed to examine the role of exercise as a strategy to regulate mood-related symptoms.

1. Introduction

Individuals with BD have a higher mortality rate (Hayes et al., 2015; Polednak, 2013) and lower quality of life (QoL) (Freeman et al., 2009) than those without this diagnosis as a result of the direct effects of their fluctuating moods, and the underlying biology thereof. They are at an increased risk of metabolic disorders and related co-morbid conditions compared to their healthy peers (Vancampfort et al., 2015a, 2013), which is in part related to side-effects of their treatment regimen. For many individuals, these health disparities may have their beginning in adolescence, with the onset of the illness. For example, second-generation antipsychotics may be part of the treatment regimen for adolescents with BD, particularly as a short term solution to alleviate symptoms of mania (Correll et al., 2010; Goldstein, 2012; Goldstein et al., 2011). Although they are effective mood stabilizers, they also have adverse side effects, such as increased weight gain, drowsiness and other related metabolic irregularities, which can lead to chronic diseases such as diabetes and cardiovascular disease (Babić et al., 2010; Chang et al., 2009; Goldstein et al., 2011).

These direct and indirect effects of BD have traditionally been addressed using pharmacological, psychosocial and behavioural

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http://dx.doi.org/10.1016/j.jad.2015.10.018
0165-0327/

approaches. Yet, a physical approach to symptom management may also be effective. Physical inactivity is a modifiable risk factor for many of these metabolic disturbances and chronic diseases (Blair and Brodney, 1999; Lee and Skerrett, 2001; Paffenbarger et al., 1986; Warburton et al., 2006). However, comparisons in exercise participation among individuals (in particular adults) diagnosed with BD with otherwise healthy individuals are inconsistent, with some studies demonstrating adults with BD to be less active than their healthy peers (Elmslie et al., 2001; Kilbourne et al., 2007) and other studies demonstrating no difference (Cairney et al., 2009). A recent comparison of 86 adolescents with BD and 50 healthy controls found that adolescents with BD were less likely to meet recommended benchmarks for vigorous physical activity (i.e. working out more than four times in the prior week). In contrast, there was no significant difference between subjects and controls in terms of incidental physical activity (i.e. working in) and/or sedentary behaviour (as measured by screen time) (Jewell et al., 2015). Exercise promotion among adolescents with BD may be particularly important given the adverse physical health consequences many may experience due to the illness and its treatment. Adults with BD are at significantly increased risk of cardiovascular disease and early and assertive prevention strategies, that include physical activity, are recommended for people with BD (Goldstein et al., 2015).

Exercise participation may also promote mental health. One prominent avenue of research has examined the acute effects of a single bout of exercise on psychological constructs such as affect, mood and emotions (Ekkekakis, 2013). Emotions are usually characterized as the immediate feelings that arise from an assessment and evaluation of a particular situation as either favourable or unfavourable to one's personal well-being (Ekkekakis and Petruzzello, 2000). Mood, however, is often a longer held state and it arises from an evaluation of oneself and one's place in the world (Ekkekakis and Petruzzello, 2000). Affect is the basic, "experiential component of all valenced (i.e. good or bad) responses, including emotions and moods" (Ekkekakis and Petruzzello, 2000). The simple question here is whether a bout of exercise makes people feel good? Systematic and meta-analytic reviews consistently demonstrate that it does but there are many moderating variables that influence this relationship – such as the intensity, duration, or even location of the exercise (Ekkekakis and Petruzzello, 1999).

In terms of BD, a disorder marked by dysfunctional shifts in affect, there is a clear rationale for examining whether exercise might be successfully used as a strategy for regulating how one feels. For example, exercise might alleviate depressive mood and increase positive activated affect (Reed and Ones, 2006). Although evidence is scarce in the context of BD (Thomson et al., 2015; Wright et al., 2009), preliminary evidence does suggest that exercise may support mood management, particularly during depressive phases. Of note is one qualitative study that explored perceptions of exercise among 25 adults with BD. Some participants reported exercise to be a useful way to manage fluctuations in their moods, whereas others reported that it made their symptoms worse, particularly when they were in a manic stage (Wright et al., 2012).

An additional reason for focusing on how exercise makes people feel is the potential link to longer-term adherence to exercise. One of the major determinants of regular exercise behaviour in the healthy population is previous pleasurable experiences (indicative of affect) (Williams et al., 2008). In this case, the assumption is that if a bout of exercise makes people feel good then they are more likely to continue to exercise in the future. There is some evidence supporting this assumption. Schneider et al. (2009a) conducted a study to examine affective responses to two acute bouts of exercise (30 min each) at two intensities (above and below the ventilatory threshold [VT]) among a group of 124 healthy adolescents. Participants then wore accelerometers for the following seven days to assess physical activity. Adolescents who reported positive affective responses during the moderate-intensity (below-VT) exercise condition participated in significantly greater amounts of moderate-to-vigorous physical activity during the following week than those who did not (Schneider et al., 2009a).

In summary, examining the mental health benefits of an acute bout of exercise for individuals with BD is important for two reasons. First, short-term improvements in mood and emotions may be important in their own right in managing the disorder. Second, the emotional response to exercise may be important for continued exercise adherence – critical for addressing and possibly preventing the physical health problems commonly associated with BD. However, no research has examined the impact of an acute bout of exercise on emotions among youth or adults with BD.

There is also some evidence that adults with BD have a reduced tolerance for exercise as compared to healthy controls (Vancampfort et al., 2015b). In other words, adults with BD are not able to maintain moderate intensity exercise as long as healthy controls, possibly because these individuals tend to weigh more, are likely to smoke and be on antipsychotic medications (Shah et al., 2007). These factors may adversely affect their energy metabolism (Alsuwaidan et al., 2009; Andreazza et al., 2010), leading to lower exercise tolerance, and possibly different affective experiences than their healthy peers. A similar scenario may also be present among adolescents with BD.

Therefore, the purpose of this secondary analysis was to examine if adolescents with BD experience changes in exercise-related emotions after one bout of moderate exercise similar to healthy adolescents. Findings may have implications for the appropriate prescription of exercise for adolescents with BD. We hypothesized that adolescents with BD would experience exercise differently than adolescents without BD. This data analysis is part of a larger study aimed at investigating changes in cerebral perfusion and cognitive function in response to a bout of aerobic exercise among adolescents with and without BD.

2. Methods

2.1. Participants

Participants were recruited from the Centre for Youth Bipolar Disorder at Sunnybrook Health Sciences Centre and from the community via advertisements. Participants were only eligible if they were English-speaking, between the ages of 13 and 20, of any race or ethnicity and either met the diagnostic criteria for BD as determined by their psychiatrist *or* had no major or recent psychiatric disorders (no lifetime mood or psychotic disorders, no recent alcohol or drug dependence in the past 3 months, and no recent anxiety disorders within the past 3 months), and no family history of BD or psychotic disorder (first and second degree relatives). The Schedule for Affective Disorders and Schizophrenia for School-Aged Children, Present and Lifetime version (K-SADS-PL), a semi-structured diagnostic interview, was utilized for diagnostic purposes (Kaufman et al., 1997). DSM-IV criteria were confirmed for bipolar subtype BD type I (BD-I) and BD type II (BD-II), and BD not otherwise specified (BD-NOS) was defined using operationalized criteria from the Course and Outcome of Bipolar Youth (COBY) study (Birmaher et al., 2006).

Participants were excluded if (1) they could not provide informed consent (e.g. severe psychosis, developmental delay); (2) there was the presence of existing cardiac condition,