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## Exercise for mood and anxiety disorders: The state-of-the science

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The use of exercise as an intervention for mood and anxiety disorders is attractive for many reasons. Exercise can be free and immediately available to everyone. This is particularly important given the scarcity of trained cognitive behavior therapists and psychiatrists. Exercise is not associated with the side effect profiles of medications. Also, exercise does not carry the same stigma as psychotherapy or medications; indeed, most people are proud to say they exercise. Finally, exercise functions as an effective transdiagnostic intervention that is easy to disseminate compared to the growing number of empirically supported treatments that each require specialized training.

A large literature shows physical exercise improves physical health (Pate et al., 1995) and reduces suffering from mood and anxiety disorders (Asmundson et al., 2013; Joshua J. Broman-Fulks & Urbaniak, 2012; DeBoer, Powers, Utschig, Otto, & Smits, 2012; Goodwin, 2003; Stathopoulou, Powers, Berry, Smits, & Otto, 2006). Given such findings, international guidelines recommend regular exercise of at least 150 minutes of moderate-intensity aerobic exercise each week (WHO, 2011). Roughly half of the population currently meets this criteria and the figure is rising (Centers for Disease Control and Prevention (CDC), 2013). The fitness industry growth started in the 1970's and 1980's with the popularity of running and aerobics. Since that time global spending on fitness has dramatically risen (Euromonitor International, 2012); for example, United States gym memberships (half private and half public/nonprofit clubs) rose from approximately \$17 to \$55 million and fitness industry revenue grew from roughly \$4 to \$25 billion US dollars (IHRSA, 2014). Unfortunately, despite a rise in leisure-time exercise, overall physical activity has dramatically declined over time (Brownson, Boehmer, & Luke, 2005; Dollman, Norton, Norton, & Cleland, 2005; Norman, Bellocco, Vaida, & Wolk, 2003). Although people now go to gyms and exercise more in their time off, they still do not fully compensate for the lost physical activity from modernization (improvements in transportation and less physical work). In order to reap physical and mental health benefits, it is more important than any other time in history to make the most of the limited exercise we get.

Given the brief time available to exercise, research is underway to improve the efficacy and efficiency of exercise to treat mood and anxiety disorders. There are basic questions that need to be answered to make the most of exercise interventions as a means of symptom reduction. In this special issue of *CBT* we asked authors to contribute manuscripts answering some of these questions. The resulting 9 manuscripts are the beginning of a burgeoning

research agenda that is certain to have positive mental health benefits for the millions of people with mood and anxiety disorders.

The first five articles test the impact of exercise on various individual difference variables important to clinically significant anxiety—*anxiety sensitivity (AS)*, *intolerance of uncertainty (IU)*, *distress tolerance*, *discomfort intolerance*, and *panic disorder outcomes*. Broman-Fulks, Kelso, and Zawilinski (this issue) randomized 77 healthy participants to a single bout of 20 minutes of aerobic exercise, resistance training, or rest followed by a 35% CO<sub>2</sub> inhalation. Results showed that both exercise conditions reduced AS; but, only aerobic exercise reduced CO<sub>2</sub> anxious responding. Neither form of exercise reduced distress tolerance, discomfort intolerance, or state anxiety. LeBouthillier and Asmundson (this issue) conducted an experiment showing that a single bout of aerobic exercise uniquely reduces AS but not IU or distress tolerance.) Sabourin, Stewart, Watt, and Krigolson (this issue) showed that running as interoceptive exposure followed by a 3-day group CBT intervention reduces AS. Hovland, Johansen, Sjøbø, Vøllestad, Nordhus, Pallesen, Havik, Martinsen, and Nordgreen (this issue) describe a feasibility study on combining internet-based cognitive behavior therapy with physical exercise as treatment for panic disorder. Their preliminary results suggest combined treatment is both feasible and beneficial. These articles suggest aerobic exercise is effective for specifically reducing AS but not distress tolerance. Interestingly, in the fifth article, Medina, Hopkins DeBoer, Powers, and Smits (this issue) describe how a hatha yoga intervention does reduce the transdiagnostic risk and maintenance factor of distress intolerance.

The sixth and seventh articles respectively describe the use of exercise alone and as a mean to augment exposure therapy for posttraumatic stress disorder (PTSD). In a randomized controlled trial, Fetzner and Asmundson (this issue) showed that aerobic exercise alone (without any therapy) reduced symptoms of PTSD. This effect was not moderated by attention focus (toward somatic sensations, distraction, or no instruction/exercise only). Powers, Medina, Burns, Kauffman, Monfils, Asmundson, Diamond, McIntyre, and Smits (this issue) conducted a randomized controlled trial and showed that exposure therapy preceded each week by exercise increased brain-derived neurotrophic factor (BDNF)—a protein shown to play an important role in the extinction of conditioned fear—and reduced PTSD symptoms more than exposure therapy without exercise. In the eighth article, Rector, Richter, Lerman, and Regev (this issue) treated participants with obsessive compulsive disorder (OCD) using group CBT and gym prescribed exercise. They found very large pre- to post-treatment within group effect sizes for the combined intervention on several measures of OCD and other symptoms. Finally, Nyström, Neely, Hassmén, and Carlbring (this issue) systematically reviewed randomized controlled studies of physical activity for major depressive disorder, finding that individually customized physical activity, of at least 30 minutes and performed under supervision with a frequency of at least three times per week is recommended when treating major depressive disorder.

These 9 articles begin to shed light on some of the basic research questions regarding how to most efficiently apply various forms of physical activity to positively influence various individual difference factors associated with anxiety and its disorders and to reduce mood and anxiety disorder symptoms. In addition to providing insights on the state-of-the-science,

the findings reported in these articles also raise a number of intriguing questions, such as the specificity of effects on anxiety-related individual difference factors, required exercise dosing, and the application of exercise alone versus as an augmentation to cognitive behavior therapy for mood and anxiety disorders. We hope this issue and the articles within stimulate the continued growth of this burgeoning research area.

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