



Effects of a Sedentary Behavior—Inducing Randomized Controlled Intervention on Depression and Mood Profile in Active Young Adults

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Abstract

Objective: To examine the effects of a free-living, sedentary behavior—inducing randomized controlled intervention on depression and mood profile.

Patients and Methods: Participants who were confirmed to be active via self-report and accelerometry were randomly assigned to either a sedentary behavior intervention group (n=26) or a control group (n=13) by using a 2:1 sample size ratio for intervention and control groups. The intervention group was asked to eliminate all exercise and minimize steps to 5000 or less steps/d for 1 week, whereas the control group was asked to continue normal physical activity levels for 1 week. Both groups completed a depression (Patient Health Questionnaire-9) and mood (Profile of Moods States) survey preintervention and immediately postintervention. The intervention group was asked to resume normal physical activity levels for 1 week postintervention and then completed the assessments for a third time. All data collection occurred between September 1, 2015, and December 1, 2015.

Results: Patient Health Questionnaire-9 group \times time interaction analysis revealed that depression scores significantly increased from visit 1 to visit 2 ($F=11.85$; $P=.001$). Paired t tests comparing depression scores from visit 2 to visit 3 exhibited a significant decrease from visit 2 to visit 3 ($P<.001$). Profile of Moods States group \times time interaction analysis paralleled depression results; mood scores significantly increased from visit 1 to visit 2 ($F=10.03$; $P=.003$) and significantly decreased from visit 2 to visit 3 ($P<.001$).

Conclusion: A 1-week sedentary behavior—inducing intervention has deleterious effects on depression and mood. To prevent mental health decline in active individuals, consistent regular physical activity may be necessary.

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Mental illness affects nearly 25% of the US adult population,¹ with mood disorders affecting nearly 10% of the adult population.² Depression and mood are interrelated, with depression classified as a mood disorder.³ The depression mood disorders included in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* include major depressive disorder, disruptive mood disorder, persistent depressive disorder (dysthymia), and premenstrual dysphoric disorder.⁴

Mood disorders can have a profound effect on various aspects of one's life, including personal relationships as well as academic and work-related performance,⁵ which has led to

abundant research examining various treatment options. Individuals suffering from a mood disorder may experience feelings of hopelessness, low-self esteem, excessive guilt, difficulty concentrating, sensitivity to failure, decreased decision-making abilities, irritability, and aggression, among others.⁶ Although extensive previous research has evaluated the effectiveness of psychotherapy and pharmacotherapy for treatment of mental disorders, physical activity has also been implemented as an alternative treatment of mental disorders because of its many global health benefits.⁷⁻⁹ For instance, physical activity has been attributed to decreased risk of cardiovascular disease, heart attack, stroke, certain cancers, type 2

diabetes, and obesity as well as an increased overall quality of life.⁹⁻¹⁷ Previous reviews of exercise and mental health research have highlighted that most experimental research on exercise and mental disorders supports the antidepressive properties of exercise as well as its ability to increase positive mood-related attributes (eg, cheerfulness).¹⁸ Both chronic exercise interventions and acute bouts of exercise have been shown to improve depression and mood states.^{18,19} Epidemiological work also supports the inverse association between physical activity and depression symptomatology.²⁰⁻²⁴

There are a number of proposed explanations for the relationship between exercise and improved mood and reduced depression symptoms, including both psychological and physiological mechanisms. Among such psychological mechanisms are the *distraction hypothesis* (diversion from unpleasant stimuli of daily life can lead to improved mood state after exercise),^{25,26} *self-efficacy theory*²⁷ (increased confidence in one's ability to exercise and maintain a schedule of regular exercise may translate to improved self-confidence in the ability to handle events that challenge one's mental health),^{28,29} *mastery hypothesis* (mastering exercise techniques and completing workouts can induce feelings of independence and success, which can translate over into other areas of one's life),³⁰ and *social interaction hypothesis* (social relationships and mutual support from others during exercise can have a positive effect on one's mental health).³¹ Among the proposed physiological mechanisms are the *monoamine hypothesis* (exercise improves brain aminergic synaptic transmission, affecting monoamines such as noradrenaline, dopamine, and serotonin, all of which have been implicated in depressive disorders),^{32,33} *endorphin hypothesis* (endorphins are produced as a result of exercise, which help to reduce pain and induce a state of euphoria),^{29,34} and *thermogenic hypothesis* (body temperature elevations resulting from exercise may elicit improved mood).³⁵ Another proposed explanation is that exercise increases resistance against stress-related psychiatric disorders such as depression through variables such as perceived control.³⁶ Although there are numerous possible explanations, there is no overwhelming evidence supported by randomized controlled interventions to confidently isolate one as the prominent

mechanism.²⁵ Considering that only 48% of adults meet recommended daily physical activity guidelines,³⁷ it is also imperative that we consider how sedentary behavior may affect mental health.

Recent suggestions that sedentary behavior has detrimental effects on one's health independent of one's physical activity levels has inspired a new line of research on the effects of sedentary behavior.³⁸ Associations between sedentary behavior and various mental health outcomes such as depression, anxiety, and self-esteem have been reported.³⁸⁻⁴⁰ In addition, sedentary behavior has been associated with negative physical health outcomes including increased risk of obesity and type 2 diabetes, both of which have been linked with poor mental health,^{41,42} which may be ameliorated with physical activity.⁴³ Notably, most research on the consequences of sedentary behavior has come from cross-sectional observation studies, which preclude any ability to ascertain temporality, and thus cause and effect. To better understand the relationship between sedentary behavior and mental health outcomes as well as the mechanisms that affect these relationships (which may differ from physical activity/mental health mechanisms), future high-quality longitudinal and interventional research is needed.⁴⁰

The purpose of this study was to build on current understanding of these relationships via a sedentary behavior–inducing randomized controlled intervention. In an “active” sample, we assessed depression and mood both pre- and postintervention to determine whether a sedentary behavior–inducing intervention (ie, minimizing physical activity and thus increasing sedentary behavior) had a detrimental effect on either of the outcomes (mood and depression). We hypothesized that active individuals whose sedentary behavior was increased for 1 week would have higher postintervention levels of depression as well as worsened postintervention mood. In addition, we hypothesized that depression levels would decrease after normal activity was resumed whereas mood state would improve (ie, return to their normal/baseline levels). This hypothesis is plausible because previous research has suggested that increasing physical activity may elicit mental health benefits.¹⁸ Thus, we believe it was reasonable to suggest that mental health

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