

## Neuropsychological Benefits of Stationary Bike Exercise and a Cybercycle Exergame for Older Adults with Diabetes: An Exploratory Analysis

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### Abstract

#### Objective:

This quasi-experimental exploratory study investigated neuropsychological effects of exercise among older adults with diabetes mellitus (DM) compared with adults without diabetes (non-DM), and it examined the feasibility of using a stationary bike exergame as a form of exercise for older adults with and without diabetes. It is a secondary analysis that uses a small dataset from a larger randomized clinical trial (RCT) called the Cybercycle Study, which compared cognitive and physiological effects of traditional stationary cycling versus cybercycling.

#### Methods:

In the RCT and the secondary analysis, older adults living in eight independent living retirement facilities in the state of New York were enrolled in the study and assigned to exercise five times per week for 45 min per session (two times per week was considered acceptable for retention in the study) by using a stationary bicycle over the course of 3 months. They were randomly assigned to use either a standard stationary bicycle or a "cybercycle" with a video screen that displayed virtual terrains, virtual tours, and racing games with virtual competitors. For this secondary analysis, participants in the RCT who had type 2 DM ( $n = 10$ ) were compared with age-matched non-DM exercisers ( $n = 10$ ). The relationship between exercise and executive function (i.e., Color Trials 2, Digit Span Backwards, and Stroop C tests) was examined for DM and non-DM patients.

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**Abbreviations:** (ACSM) American College of Sports Medicine, (AHA) American Heart Association, (DM) diabetes mellitus, (non-DM) patients without diabetes mellitus, (RCT) randomized clinical trial, (T2DM) type 2 diabetes mellitus

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**Abstract cont.**

**Results:**

Older adults with and without diabetes were able to use cybercycles successfully and complete the study, so the feasibility of this form of exercise for this population was supported. However, in contrast with the larger RCT, this small subset did not demonstrate statistically significant differences in executive function between the participants who used cybercycles and those who used stationary bikes with no games or virtual content on a video screen. Therefore, the study combined the two groups and called them “exercisers” and compared cognitive outcomes for DM versus non-DM patients. As predicted, exercisers with DM exhibited significant gains in executive function as measured by the Color Trails 2 test, controlling for age and education, while non-DM exercisers did not significantly gain in this measure [group  $\times$  time interaction,  $F(1,16) = 9.75$ ;  $p = .007$ ].

**Conclusions:**

These preliminary results support the growing literature that finds that exercise may improve cognition among older adult with DM. Additional research is needed to clarify why certain aspects of executive function might be differentially affected. The current findings may encourage physicians to prescribe exercise for diabetes management and may help motivate DM patients’ compliance for engaging in physical activity.

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