

# Run for Cognitive Benefits: Effect of Aerobic Exercise on Cognition

Janae J. Hellie, Ariel C. Reid, and Bruce D. Bainum

## Current Research

- The amount of exercise on a weekly basis is positively correlated with performance on tasks measuring cognitive flexibility (Masley, Roetzheim, Gualtieri, 2009).

- Subjects who were exercising at a level of high intensity recognized the single feature and conjoined feature targets more quickly than those who exercised at a level of moderate intensity or those who were resting (Allard, Brawley, Deakin, and Elliott, 1989).

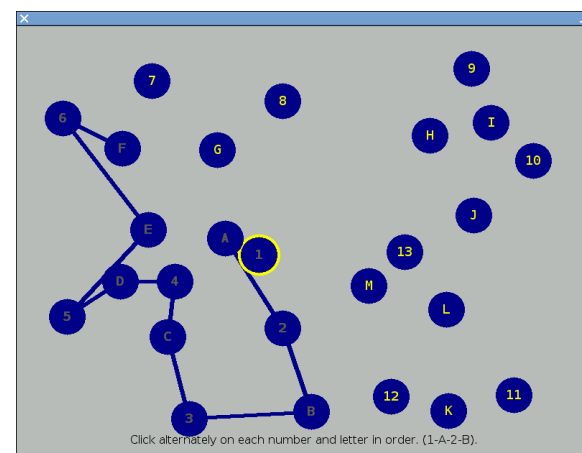
- Aerobic exercise significantly increases visuospatial memory, but has no significant influence on verbal memory (Stroth, Hille, Spitzer, and Reinhardt, 2009).

## Purpose and Hypotheses

Little research has investigated the duration of aerobic exercise and cognitive flexibility, processing speed, spatial memory, and short-term memory. The purpose of the current study was to investigate the effects of aerobic exercise and the duration of that exercise on cognitive flexibility, processing speed, spatial memory, and short-term memory.

- Hypothesis 1: Participants who engaged in aerobic exercise for 15 minutes would perform significantly better on measurements of cognitive flexibility, processing speed, spatial memory, and short-term memory than participants who did not engage in aerobic exercise.

- Hypothesis 2: Participants who engaged in aerobic exercise for 30 minutes would perform significantly better on measurements of cognitive flexibility, processing speed, spatial memory, and short-term memory than participants who engaged in aerobic exercise for 15 minutes and those who did not exercise.



## Measures

The Trail Making B test was used to measure cognitive flexibility. In this test participants connected numerous circles by clicking on them in a 1-A, 2-B order as quickly as possible. The Go/No Go Assessment measured processing speed. Participants pressed the spacebar as quickly as possible when a designated fruit appeared and resisted pressing the spacebar when any other image appeared. The spatial recognition assessment measured spatial memory. In this test five squares appeared on the screen one at a time in different locations, while participants memorized the locations. The Digit Span Assessment measured short-term memory.

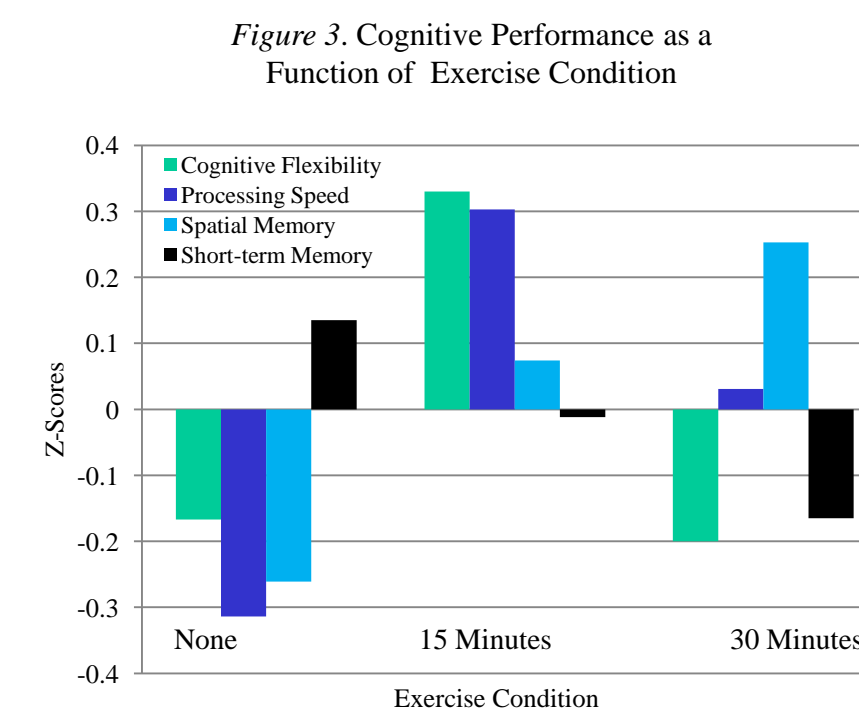
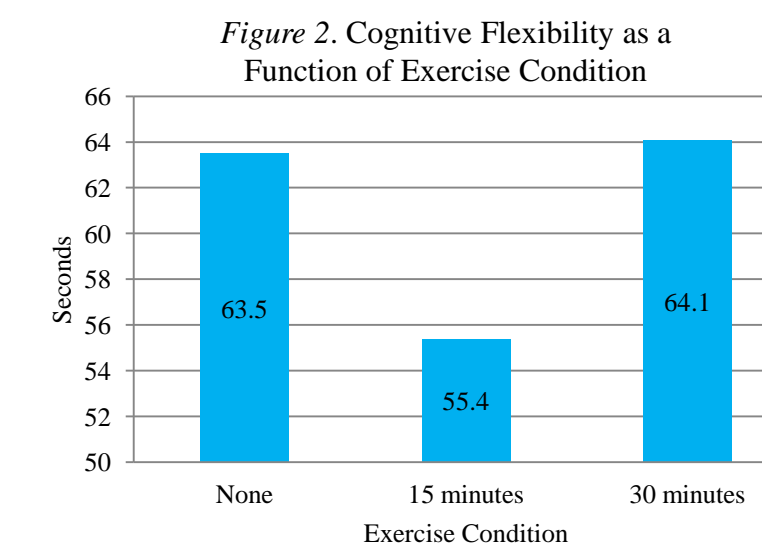
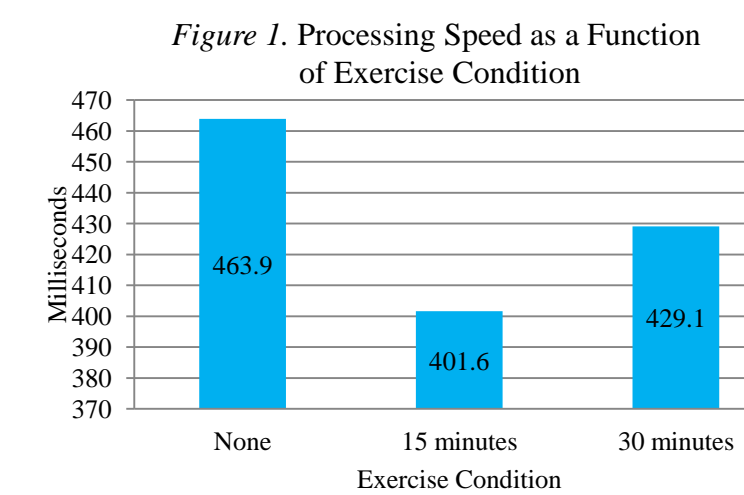
## Method

Participants consisted of 65 undergraduate students, 30 men (46.2%) and 35 women (53.8%), from a small liberal arts college in northern California. Prior to signing up for the experiment, all participants were informed they had to be physically able to perform 30 minutes of aerobic exercise on a treadmill.

All participants were randomly assigned to one of the three conditions: control (no aerobic exercise), 15 minutes of exercise or 30 minutes of exercise. Participants were asked not to engage in any physical exercise within 24 hours prior to their participation in the experiment. Upon arrival, participants in the control condition were escorted to a quiet room to complete all four of the cognitive assessments in a predetermined random order. Participants in the 15-minute condition had 70% of their maximum heart rate calculated ( $220 - \text{age} \times .07$ ) and after a 2.5 minute warm-up, engaged in 15 minutes of aerobic exercise within 70% of their maximum heart rate. They were then escorted to a quiet room to complete the four cognitive assessments. Participants in the 30-minute condition were treated the same, except that they exercised for 30 minutes within 70% of their maximum heart rate.

## Abstract

The purpose of the present study was to examine the effect that duration of aerobic exercise has on cognitive function. It was hypothesized that those who engaged in aerobic exercise for a longer duration would perform better on four cognitive measures compared to those who exercised less or not at all. Participants engaging in 15 minutes of aerobic exercise performed significantly faster on a processing speed task and marginally faster on a test of cognitive flexibility compared to those in the control condition. No differences were found between any groups on spatial memory or short-term memory scores. The study supports previous research demonstrating the ability of exercise to improve processing speed and cognitive flexibility, in a variety of daily tasks.



## Results

The first hypothesis, that participants who engaged in aerobic exercise for 15 minutes would perform significantly better on measurements of cognitive flexibility, processing speed, spatial memory, and short-term memory compared to participants who did not engage in aerobic exercise, was partially supported. Those in the 15-minute condition performed significantly faster on the processing speed test compared to those in the control condition,  $t(45) = 2.20, p = .035, d = .65$  (Figure 1).

In addition, those in the 15 minute condition had marginally faster times on the cognitive flexibility test compared to those in the control condition,  $t(45) = 1.83, p = .074, d = .55$  (Figure 2).

The second hypothesis, that participants who engaged in aerobic exercise for 30 minutes would perform significantly better on the four cognitive tests compared to participants who engaged in aerobic exercise for 15 minutes and those who did not exercise, was not supported (Figure 3).

## Discussion

Those who exercised for 15 minutes performed significantly faster on the measurement of processing speed and marginally faster on the measurement of cognitive flexibility. Participants who engaged in aerobic exercise for 30 minutes performed no better on the four cognitive tests than participants who engaged in aerobic exercise for 15 minutes and those who did not exercise. Some participants were experiencing more dizziness and exhaustion when exercising for 30 minutes instead of 15 minutes. It could be that those who engaged in aerobic exercise for 30 minutes experienced more fatigue resulting in poorer performance on the cognitive tests, which were taken immediately after the exercise was completed.

Processing information faster makes one more efficient and gives one more time to complete the task at hand. Similarly, improving cognitive flexibility is key to being more efficient at daily tasks. Exercise is not only a way to improve one's physical health; it appears to be a healthy way of improving one's cognitive performance as well.