Introduction

- Through a meta-analysis of 79 studies Chang, Labban, Guinip, and Etnier (2012) observed a small positive effect of exercise on cognition.
- Exercise has also been shown to elicit arousal-dependent effects (inverted U hypothesis) on cognitive performance (Arent & Landers, 2003).
- Some research suggests participant fitness may moderate the effect of exercise on cognitive performance (e.g. Brisswalter, Arcelin, Audiffren, & Delignieres, 1997; Chang et al., 2012).

The present study examined the effect of acute moderate exercise on executive function as measured by the Stroop and the Paced Auditory Serial Addition Test (PASAT). Participants completed both single and dual cognitive tasks at four walking paces and during a stationary period.

Hypotheses

- Cognitive performance measured by Stroop reaction time (RT) and accuracy will vary with walking paces, with improvement at slower paces and impairment at faster paces.
- Changes in cognitive performance will be more pronounced during dual tasking conditions with greater cognitive load.

Methods

Participants

- A total of 64 students (46.9% male, 53.1% female) participated for course credit.

Materials and Procedure

- The Stroop test was administered on a laptop through a software program (E-Prime®) during single and dual tasking trials.
- The PASAT was also used to measure cognitive function during dual tasking trials.
- Participants were randomized into one of four conditions, which partially counterbalanced the four walking speeds (stationary, 5, 1.5, 2.5, and 3.5 mph).

Results

The Effects of Walking Speed on RT and Accuracy

- There was a highly significant effect of walking speed on Stroop RT.
- Results showed only marginal effects of walking speed on Stroop accuracy and no observable effect on PASAT accuracy.

<table>
<thead>
<tr>
<th>Stroop Friedman Results</th>
<th>df</th>
<th>p</th>
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<tbody>
<tr>
<td>Single Tasking Accuracy</td>
<td>72</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Dual Tasking Accuracy</td>
<td>72</td>
<td>&lt;.001</td>
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<tr>
<td>Single Tasking RT</td>
<td>72</td>
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Post-Hoc Analysis

- Participants had significantly better single tasking Stroop RT at 3.5 mph compared to 1.5 mph (S = -424.00, p = .004).
- Single and dual tasking RT were significantly better at .5 mph compared to 1.5 mph (S = 620.00, p < .001; S = 771.00, p < .001) and stationary (S = 532.00, p < .001; S = 527.00, p < .001).

Self-Reported Fitness

- Cognitive performance did not significantly differ based on participants’ self-fitness rating.
- Results from the GPAQ showed that participants’ average weekly metabolic equivalent minutes spent being physical activity (M = 3263.13, SD = 2227.27) was not correlated to Stroop or PASAT performance.

Discussion

- Overall, results showed a significant effect of acute moderate exercise on cognitive performance.
- Interestingly, participants’ Stroop RT tended to peak at .5 mph for both single and dual cognitive tasking trials.
- Compared to other walking paces, participants had to be much more intentional about their walking at .5 mph since the pace was extremely slow. This may have increased arousal, which consequently increased participants’ cognitive performance.
- Participants’ self-reported physical fitness and average levels of self-reported physical activity did not have any significant relationship to performance on the cognitive tests.
- Previous research has suggested that self-reported physical activity may not be reliable (Prince et al., 2008).

Future Research

- We hypothesize that increases in cognitive ability during moderate exercise may be due to increased cerebral blood flow (e.g. Endo et al., 2013, Guiney, Lucas, Cotter, & Machado, 2015; Hellstrom & Wahlgren, 1993).
- Additionally, we are examining heart rate during and after exercise as an indicator of participants’ physical fitness.
- It is expected that this objective indicator will support that participant fitness moderates the effect of exercise on cognitive performance.

References


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