The Effect of Physical Activity vs. Cognitive Activity on 4-Choice Reaction Time

Introduction
Exercise is associated with an increase in cardiovascular functional ability and improved brain health. In everyday life, mental stimulation is more common than physical stimulation through exercise. However, research on the benefits of psychomotor control and exercise remain controversial. One study reports that adults who exercise aerobically have faster audio and visual reaction times (Garg, et al., 2013). On the other hand, results from another study indicate there was no significant effect on reaction time from various types of stretching when simple reaction time was used as a measurement (Chatzopoulos, et. al., 2014). Thus, we set out to compare the effects of physical and mental stimulation in a 4-choice reaction time task to determine if physical and/or mental stimulation impacted reaction time.

Purpose and Hypothesis
Objective: To determine whether physical stimulation or mental stimulation yields a faster reaction time.
Hypothesis: Participants will exhibit a faster reaction time after physical stimulation compared to mental stimulation and the control condition.

Participants
- n=12; 6 women, 6 men
- Undergraduate students ranging in (age 18-22)

Methods
The 4-choice reaction-time system is a method that measures movement time and reaction time in response to a visual stimulus. Each participant underwent 3 sets of 16 repetitions, consisting of an auditory warning followed by the lighting of one of four buttons (randomly selected by the computer). The participant must press the lighted button as quickly as possible from a designated starting point (blue button).

Our procedure is as follows:
- Measure resting heart rate
- Acclimate subject to a 4-choice reaction test (4-CRT)
- Administer control set of 4-CRT trials
- Have participant perform 3 minute physical activity (jumping jacks, high-knees, and sprint kicks in said order) and measure heart rate
- Administer physical stimulation set of 4-CRT
- Re-obtain resting heart rate
- Perform Stroop test
- Administer final set of 4-CRT trials

Results
Average Reaction Time: Cognitive vs. Physical Stimulation

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Reaction Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>380</td>
</tr>
<tr>
<td>After Physical</td>
<td>360</td>
</tr>
<tr>
<td>After Mental</td>
<td>380</td>
</tr>
</tbody>
</table>

Discussion
In conclusion, the hypothesis was not supported. The results indicate that neither physical nor mental stimulation yielded a significant change in 4-choice reaction time. These results are in contrast to the study in which physical activity decreased reaction time (Garg, et al., 2013). The direction of the means indicates stimulation may decrease reaction time, but this study had low power (the statistical ability to determine differences between means based on means and standard deviations). The recommended power is 0.8 and this study had 0.2, indicating our sample size was too small given the variability of our data. Additional study with more participants is needed to adequately test the hypothesis.