THE EFFECT OF AN ACUTE EXECISE BOUT ON ACADEMIC PERFORMANCE OF KINESIOLOGY UNDERGRADUATE STUDENTS

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ABSTRACT

Johnson, AM, O'Brien, JS, Dahlke, LM. The effect of an acute exercise bout on academic performance of Kinesiology undergraduate students. *J. Undergrad. Kin. Res. 2006; 1(2): 23-30.* This study compared the difference of academic performance on a standardized exam between a group who exercised beforehand and a group that did not exercise. To complete this test, we took 14 subjects who were all Kinesiology majors at the University of Wisconsin – Eau Claire. The test subjects were between the ages of 21 – 35 years of age. Subject weight, height, and resting heart rate were 78.5 kg, 172.6 cm, 64.9 bpm, respectively. We used the resting heart rate to calculate their heart rate reserve which we then used as an exercise intensity level. Seven of the subjects were randomly chosen to exercise for 20 minutes prior to taking the test. For these subjects, we took their blood pressure before and after exercise as a safety precaution. The other seven subjects were chosen to take the test only. The two groups were compared to see if there was a significant difference between the exercise and non-exercise group. We found no significant difference in test score between the exercise group (M = 74.1) and the non-exercise group (M = 72.4), t (12) = .368, p>.05. We suggest that further research should be conducted to determine if there is a relationship between exercise and cognitive functions.

Key Words: BDNF, cognition, physical activity, exercise, sedentary, mortality, morbidity, synaptic plasticity.

INTRODUCTION

Physical activity and exercise have many benefits, including improvement in cardiovascular and respiratory function, reduction in coronary artery disease risk factors, and decreased mortality and morbidity (1). Even though there seems to be known health and physical benefits related to exercise, recent reports indicate that more than 40% of adults do not engage in recommended amounts of physical activity (1). Many factors can lead to a sedentary lifestyle including time constraints, lack of motivation, lack of access to training facilities, and money constraints. Additionally, there is interest in determining if physical activity has a beneficial effect on cognitive performance. Numerous studies have consistently demonstrated physiological benefits, however cognitive benefits have been studied but the interpretation of these results have been diverse (2).

There can be numerous factors effecting mental performance. One example is exercise intensity which can have an inverted U-effect on the performance of a cognitive task. Also, duration can have an effect; in order to experience benefits of exercise, the individual must exercise for at least 20 minutes but exercise lasting longer than an hour can cause fatigue decreasing benefits (2). One particular study conducted by Gomez-Pinilla, Vaynman, and Ying studied the brain derived neurotrophic factor (BDNF), a molecule known for its role in synaptic plasticity. These researchers found direct evidence that exercise training was able to enhance learning acquirement and recall ability (3). In a related study, Ari, Kutlu, Taneli, Buyukyazi and Tavli found that mental reaction time and fitness level are positively correlated. This may be explained by the arousal of the central nervous system and heightened circulatory capacity. The researchers hypothesize that you may be able to relate aerobic capacity to mental reaction time (4). Another benefit of aerobic activity can also slow cognitive decline or regain some lost function in older adults according to a review written by Hall, Smith and Keele. From articles they reviewed, they believe that a vigorous exercise program across one's lifespan may help slow the effects of aging. Also, in other studies they noticed participants to slightly regain lost function after a few months of exercise (5). For these reasons, it is important to have a better understanding of how exercise will positively impact a person's cognitive function.

The purpose of this study was to determine the difference between those who had a 20 minute exercise bout to those without any prior exercise and their performance on a standardized academic test. We hypothesize that those who exercised prior to the test will academically perform better than those who did not exercise prior to the test.

METHODS

Subjects

The subjects were 14 volunteer participants, both male and female, who are Kinesiology majors at the University of Wisconsin – Eau Claire. Demographics of these subjects can be seen in Table 1. Each volunteer has completed the necessary Kinesiology core classes and also meets the ACSM guidelines for a physically active person. These guidelines require the participant to exercise most days of the week for a combined total of 30 minutes per session. Before completing the study, each participant completed a consent form. This study was approved by the Institutional Review Board (IRB).

Table 1: Subject demographics from both groups (N=14).

	Age (yrs)	Height (cm)	Weight (kg)	Resting HR (bpm)
Mean	**23.1**	**172.6**	**78.1**	**69.4**
SD	**±3.5**	**±11.6**	**±20.6**	**±6.5**

Instrumentation

To find the basic demographics of our subjects, we used a Seca 216 Height Rod (Brooklyn, NY) and took the height measurements. We then used a Detecto model 437 scale (Webb City, MO) to find the subject's weight. To measure their heart rate, a Polar F1 Heart Rate Monitor (Lake Success, NY) was used. We also took blood pressure using an ADC Proscope and Diagnostix™ 750 Series sphygmomanometer (Hauppauge, NY). To exercise, the subjects ran on either a Woodway Wide Path Treadmill (Waukesha, WI) or a Trackmaster Commercial Treadmill TMX55 (Biddeford, ME).

The academic test used was a standardized test compiled of 16 questions written by the Kinesiology professors for the following core courses of the Kinesiology—Human Performance major: Anatomical Kinesiology, Biomechanics, Exercise Physiology, Introduction to Human Performance and Motor Development Across the Lifespan. The questions were chosen to be the most significant aspects of Kinesiology courses for the Human Performance emphasis.

Data Collection Procedures

The testing will took place in Exercise Physiology Lab in McPhee, where the researchers were present for the entire length of the test. All participants were told they need to be available for a maximum of one hour. The subjects were blindly split into two separate groups, A and B. All participants were informed to take their resting heart rate the morning of their testing day. Although both groups were prepared to exercise for 20 minutes, group A were the only participants exercising for 20 minutes on a treadmill. They either walked or ran at 40-60% Heart Rate Reserve (HRR). The subjects wore heart rate monitors and had their blood pressure taken before and after the exercise for safety purposes. Before exercising, the subject's height, weight, resting heart rate and target heart rate were recorded. At the end of the 20 minute exercise, the subjects immediately took a Kinesiology Academic Test. Group B thought they would be exercising, although they are acting as the control group and just have to take the academic test. Before the subject takes the test, the researchers will get the subjects height, weight and resting heart rate. After data collection, all statistics were put into SPSS and were analyzed for statistical significance.

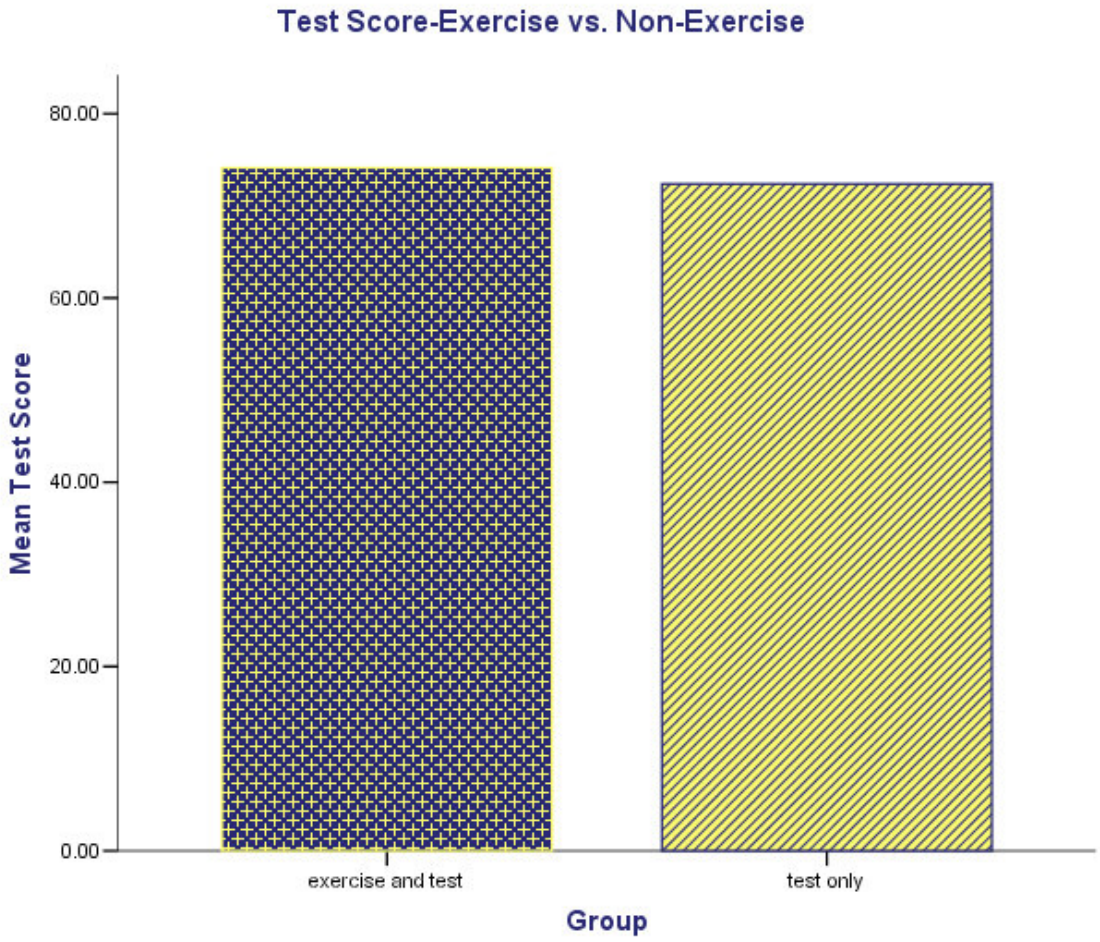
Statistical Analysis

An independent t-test was used to examine the effect of a bout of exercise vs. non-exercise, in two separate groups, before taking an academic test. Refer to Table 2 and Figure 1 for visual reference. The significance level was set at $p \leq 0.05$.

Table 2: Mean test scores for exercise group (N=7) and test only group (N=7).

	Exercise and test	Test only
Mean test score (percentage)	74.1	72.4
SD	±8.4	±9.4

Figure 1: Average test scores from the exercise group and non-exercise group.



Results

The results of this study did not support our hypothesis that an exercise bout would improve cognitive performance on an academic exam and, therefore, we failed to reject the null hypothesis. There was no significant difference in test score between the exercise group (M = 74.1) and the non-exercise group (M = 72.4), t (12) = .368, $p > .05$.

Discussion

The results of our study show that exercise has minimal effect on the standardized test that we developed. When comparing our study to other studies the results vary. On widely used standardized tests, one study compared the SAT/9 scores to overall physical fitness of the test takers. This resulted in a statistically significant positive linear relationship between physical fitness and achievement (6). However, a study done at the California State University, Fresno, on 710 students showed no significant relationship between exercise and academics. The researchers stated that there were not obvious reasons for these results. There is a possibility that overworking the body can have negative effects on academic performance. Students in one study who exercised 7 hours

per week had lower test scores than those who exercised 6 hours per week. These results demonstrate a possible cut off between appropriate amounts of exercise for an increase in academic performance (7).

On a study done on 89 high school seniors resulted in a relationship between exercise and academic performance. This study also compared levels of depression, anxiety and self-esteem. The researches also reported lower levels of depression, anxiety and higher levels of self-esteem in those who exercised regularly and participated in sports (8). This shows that exercise can not only benefit cognition, but increase serotonin levels that play a role in emotional disorders (9). In a related study conducted by Petruzello, Landers, Hatfield, Kubitz, and Salazar, exercise was used as a treatment for stress and anxiety reduction. They found that a 9 week exercise program saw less overall reduction in these emotional states than those in the 16 week program (10). We hypothesize that with decreased stress and anxiety, academic performance would be increased.

These emotions often affect college students and may have had an effect on our study's results as we conducted the test during the spring semester. Our team of researchers found no significant differences in test scores between those who exercised prior to those who did not exercise.

Limitations

Possible limitations can be due to lack of participants as well as time constraints. We also feel that a 20 minute exercise bout may not have been enough to produce positive effects on test performance. The ages of our subjects were limited to college Kinesiology students and may have inhibited our results. Although the study was limited to Kinesiology majors, it was even more confined to those who have completed certain courses. We also constructed a test based on classes completed with questions submitted by Kinesiology professors who teach the class. The test consisted of 16 questions and should have been more thorough and standardized.

Interpretations of Findings

Our study did not find a significant difference in test scores between the two groups of participants. Although our study showed only a 2% increase in exam scores, this can be a significant increase over the course of the semester and can determine the difference between grades.

Application of Findings

The findings of this study can be applied to the general population, specifically college students. Exercise has shown health benefits as well as keeping your mind healthy. It can also reduce stress, depression and anxiety.

Recommendations

Exercise can be beneficial to one's overall health. We feel it is important for everyone to exercise for known health benefits, such as decreased blood pressure, cholesterol and decreased chances of premature mortality and morbidity. We feel there is enough significant difference in exam scores to recommend that exercise can be beneficial to

academic performance. Also, those who experience emotional disorders may find exercise to be a helpful supplement.

Suggestions

We suggest that further research be conducted on the relationship between academic performance and exercise as current studies vary in results. We feel that in order to improve the quality of the study, participants should exercise between 20 and 60 minutes. This is because exercise over 60 minutes may fatigue the subject while less than 20 minutes may not be a sufficient amount of time (11). A wide variety of participants should be used to conduct future studies.

Conclusion

The main objective was to conduct a study that would show physical activity does have an effect on a person's cognitive functions. The study shows that there is no statistically significant difference between the test scores of subjects who exercised before an academic test and those subjects who did no exercise before taking an academic test. This study can be applicable to students in the age range used for this study. Students may notice an increase in test scores over their academic career as these test points add up.

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