Abstract

INTRODUCTION: Physical activity has been shown to have beneficial effects on cognition in elementary school children as well as adults. However, this relationship has remained relatively understudied in young adults. Additionally, most studies to date have utilized indirect measures of physical fitness, either self-report activity questionnaires or time-based physical performance metrics. This study was conducted to determine if a positive relationship is observed with objective measures of aerobic capacity and to what extent aerobic fitness might be associated with academic performance in an age range that more broadly developed and fully functioning brain of young adults.

Methods

As part of a larger study, 39 professionally healthy medical and nursing students (18 women) were recruited in a clinical trial to evaluate the effects of improved fitness on objective measures of cognitive ability and academic performance. We examined the correlations of the baseline measures of aerobic capacity in terms of maximum oxygen uptake (VO_{\text{max}}) and academic performance as assessed by GPA in non-clinical nursing classes or by exam scores over the first two blocks of medical school. VO_{\text{max}} was defined both as the relative value (in ml/kg/min) and as one of five categories (poor through superior) based on age- and sex-matched reference values (95%CI).

RESULTS: The subjects were aged 27.3 ± 3.2 years with body fat at 12% ± 1% (VO_{\text{max}} 3.73 ± 0.10 (L/min for 40-69.8 ± 9.8 ml/kg/min), and metabolic, (VO_{\text{max}}) threshold occurring at all 45% (3.69 ± 0.10) of VO_{\text{max}} mean (95%). Our data failed to show a significant correlation between any parameter measured and academic performance.

Conclusion: The lack of significant correlation between aerobic fitness and scholastic performance with any measure suggests that the academic performance of nurses and physicians is not supported by aerobic fitness acquired through academic training. Furthermore, it is possible that previously reported correlation did not have a psychological underpinning, but were the result of some confounding factor (e.g. motivation) that is more readily observed with a purely functional measurement.

Introduction

The advantages of physical activity and aerobic fitness are wide-ranging, from prevention of obesity-related disorders to improved psychological mood. However, the effects of exercise on cognitive function are not well understood. The majority of research in this field has focused on the two ends of the developmental spectrum, studying the relationship between exercise and cognition in elementary school children or elderly populations undergoing age-related cognitive decline.

In healthy elderly individuals, higher levels of physical fitness and more active lifestyles are associated with improved performance on executive control testing and initiation of an aerobic exercise regime has been shown to improve memory in patients with Alzheimer’s disease. However, the extent aerobic fitness might be associated with academic performance in an age range that more broadly developed and fully functioning brain of young adults.

Data Analysis

This study was conducted to determine if a positive relationship is observed between aerobic performance and a direct measurement of aerobic fitness, and to what extent this relationship may exist in a graduate student population, likely operating near peak cognitive capacity.

Methods

As part of a larger study, we recruited 39 medical and nursing students (18 women) to perform a maximal cardiopulmonary exercise test on a treadmill using an incremental running protocol while recording gas exchange via a metabolic measurement system (Oxycon Pro; Carefusion, Yorba Linda, CA, USA). From this data, we determined the aerobic capacity (VO_{\text{max}}) and the metabolic (lactate) threshold.

Figure 1. Determination of VO_{\text{max}} and metabolic threshold using gas exchange data

- Additionally, subjects completed surveys which included questions about weekly aerobic exercise performance (in hours per week) and exercise history (in total months).
- All subjects provided consent for us to obtain their academic performance data:
  - scores on the final exams of the first two blocks of medical school
  - GPA of non-clinical nursing school classes during the semester of study participation

Summary of Results

- 26 medical (9 women) and 13 nursing (9 women) students completed the assessments (age 27±5 years; height 163.2±4 cm; weight 67.1±4.7 kg; body fat 19.2±1.8%; n=39, n=13).
- Mean relative VO_{\text{max}} was 45.6 ± 8.8 ml·kg^{-1}·min^{-1} with metabolic threshold occurring at 69.8±0.1%.
- There were no significant relationships between any fitness or academic variables. (Figure 2 and Table 1)

Conclusions

1. The lack of significant correlation between aerobic fitness and scholastic performance in our population of graduate students is inconsistent with previous studies conducted among elementary and junior high school students.
2. These findings suggest that there may be a ceiling to previously reported potentially beneficial effects of aerobic fitness on cognitive function. Alternatively, it is possible that previously reported correlation did not have a psychological underpinning, but were the result of some confounding factor (e.g. motivation) that is more readily observed with a purely functional measurement.
3. Additionally, it is possible that previously reported correlations did not have a physiological underpinning, though cannot be detected by direct measure of aerobic capacity.
4. Previously reported correlations between fitness and academics may be the result of a third factor (e.g. motivation) that more readily influences a purely functional measurement such as a timed run or FITNESS GRAM.
5. Future studies should conduct direct measure of aerobic capacity in younger populations to further describe the causative pathway by which previously observed relationships exist.

References