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### Aerobic and Anaerobic Exercise: Associations with Academic Outcomes in College Students

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# **Aerobic and Anaerobic Exercise: Associations with Academic Outcomes in College Students**

## **Abstract**

Previous studies have found that physical activity is associated with greater academic achievements among students. However, it remains unclear whether associations are present in both aerobic exercise and anaerobic exercise. The purpose of this study was to examine the associations between aerobic exercise, anaerobic exercise and academic outcomes in college students. Data was drawn from a survey administered to undergraduate students attending St. John Fisher College in Rochester, NY. Students were asked to self record the type of exercise they participate in as well as their academic grade point average (GPA). The data collected was measured using two statistical models: first, two separate regression analyses with GPA as the outcome and either aerobic or anaerobic exercise as the predictor; second, a multiple regression where GPA is the outcome and both aerobic and anaerobic exercise are the predictors. The three measurements will be used to determine which form of exercise is most beneficial to the students' academic achievements. After comparing the results of the survey, it was determined that there was no significant difference between the type of physical activity that students participated in and their GPA.

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Aerobic and Anaerobic Exercise:  
Associations with Academic Outcomes in College Students.

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### **Abstract**

Previous studies have found that physical activity is associated with greater academic achievements among students. However, it remains unclear whether associations are present in both aerobic exercise and anaerobic exercise. The purpose of this study was to examine the associations between aerobic exercise, anaerobic exercise and academic outcomes in college students. Data was drawn from a survey administered to undergraduate students attending St. John Fisher College in Rochester, NY. Students were asked to self record the type of exercise they participate in as well as their academic grade point average (GPA). The data collected was measured using two statistical models: first, two separate regression analyses with GPA as the outcome and either aerobic or anaerobic exercise as the predictor; second, a multiple regression where GPA is the outcome and both aerobic and anaerobic exercise are the predictors. The three measurements will be used to determine which form of exercise is most beneficial to the students' academic achievements. After comparing the results of the survey, it was determined that there was no significant difference between the type of physical activity that students participated in and their GPA.

Aerobic and Anaerobic Exercise:  
Associations with Academic Outcomes in College Students

Improved health, an increase in energy, and weight loss are just a few of the benefits associated with participation in physical activity and exercise (Lavall, 1984). Physical activity is defined as the “activity of exerting your muscles in various ways to keep fit” and can range from playing a sport, to lifting weights, to jogging leisurely (Physical Activity, 2011). As of late, much research has been conducted to determine the psychological affects that physical activity has on individuals.

Physical activity and exercise have been associated with numerous health benefits for the body. However, recent discoveries have found that exercise has psychological benefits as well (see Barr-Anderson, 2010; Caputo, 2009; Carr, 2009). Psychological benefits include improved self-esteem, greater motivation, and elevated self worth (Sousa, 2001). Physical activity and its affect on academic ability is another area of interest that researchers have focused on. Several studies have been conducted to determine how physical activity and exercise can affect the learning ability of individuals; more specifically high school and college students (see Barr-Anderson, 2010; Caputo, 2009; Carr, 2009). In the majority of the studies, it has been found that participation in physical activity has led to improved academic performances in students (Caputo, 2009). It is important to note that mental capabilities range between individuals but overall, academic scores can gauge the distinct levels of knowledge between different groups. For that reason, GPA’s can be used to measure the effectiveness that physical activity has on students academic scores.

Simply put, knowledge is power. For individuals to succeed in today’s society, it is essential that they possess a quality education. In 2001, the U.S. Government passed the No

Child Left Behind Act, which requires states to set achievement standards for their students; proof that the demand for education and knowledge is at an all time high (Carmichael,2007). Unfortunately, many schools have reduced physical education opportunities and some have eliminated recess in order to dedicate more class time to meet these academic standards (Lavall, 1984). Additionally, most colleges and universities do not require their students to participate in physical education classes. Now that there is research that suggests exercise can translate to higher academic scores, schools may reconsider incorporating physical activity back into the educational system.

The purpose of this study is to examine the associations between aerobic exercise, anaerobic exercise, and academic outcomes. Previous studies have proven that physical activity has a positive effect on students' academic achievements (see Barr-Anderson, 2010; Caputo, 2009; Carr, 2009). However, it remains unclear whether the associations are a result of aerobic exercise, anaerobic exercise or a combination of the two. Aerobic exercise is physical activity that increases the need for oxygen in the body such as running, swimming, or dancing (Carmichael, 2007). Conversely, anaerobic exercise is physical activity that does not use much oxygen in the body such as weightlifting (Carmichael, 2007). This study will look to determine if aerobic exercise, anaerobic exercise or a combination of the two have an effect on the academic outcomes of college students. By comparing these variables, it can be determined which form of exercise is most beneficial to a students' academic achievements.

### **Theoretical Framework**

For the research in progress, a Theory of Action was used. A Theory of Action makes clear the reasoning for why a specific intervention is expected to lead to improved outcomes

(Inman, 2000). For example, why would we expect small high schools to lead to improved student outcomes? It can be assumed that the closer student to teacher ratio will contribute to more attention for each student, enhanced instruction by the educator, and ultimately improved outcomes. In this case, the study is attempting to determine if aerobic exercise, anaerobic exercise, or the combination of the two relates to a greater improvement in GPA. It is expected that the psychological benefits from exercise will contribute to the improvement of an individual's overall quality of life which will ultimately improve academic outcomes. Therefore, the act of participating in physical activity will lead to improved academic outcomes.

### **Literature Review**

Previous research conducted on the psychological aspects of exercise has concentrated on the affects of physical activity on academic outcomes. To date, a handful of studies have examined the correlations between exercise, test scores, and grade point average (GPA) (see Barr-Anderson, 2010; Caputo, 2009; Carr, 2009). In order to focus on which types of exercise will improve GPA, it must first be determined if physical activity in general has an effect on academic outcomes.

Scientific studies have been conducted on the subject of exercise as it relates to the brain. In an article published by Newsweek, scientists found scientific reasoning for improved learning skills in individuals who participated in exercise (Carmichael, 2007). In short, whenever a person exercises their body releases a chemical known as IGF-1. IGF-1 then produces brain-derived neurotrophic factors, or BDNF. BDNF causes brain cells to start branching out and connecting with each other in different ways. Every time that the brain cells connect with each other, it signifies a new fact or skill being learned. Exercising regularly builds up the BDNF levels within

the body. Therefore, brains with more BDNF have a greater capacity for knowledge whereas brains with low BDNF shut themselves off from new information (Carmichael, 2007). Whether the improvements of academic outcomes are a result of scientific or psychological reasons, students who exercise are benefiting from them.

In 2009, a study published by the Journal of Physical Activity and Health examined the relationship between physical activity and academic achievement in elementary school students (Caputo, 2009). A group of students, ages 8-10, were surveyed in the study. Students were asked to track the amount of time spent on physical activity in a given week. The study group then distributed Math and Reading/Literature tests to the students (Caputo, 2009). When comparing the test scores to the amount of physical activity, the researchers found that test scores were higher for students who participated in more physical activity (Caputo, 2009). The results of this study demonstrate the effects that physical activity has on test scores of elementary school students.

The Journal of Pediatrics published a study conducted by James W. Carr in 2009 which examined how the amount of physical activity affected student's grade point average (Carr, 2009). In the study, undergraduate college students from a four year private school were surveyed. The survey broke students into categories based on the amount of time they spent exercising at the facility (Carr, 2009). The categories included: Non- users (0 days/week), Low users (0-1 days/week), Moderate users (2-3 days/week), and High users (3 or more days/week) (Carr, 2009). The students GPA was then compared to the amount of time spent at the gym. The researchers found that the "High users" had a higher overall GPA compared to the rest of the groups (.2 greater) (Carr, 2009). This study demonstrated that the amount of time spent on



physical activity can play a role in academic outcomes and shows that college students are affected positively by exercise as well.

In January of 2010, a survey published by the Journal of School Health examined the relationship between team participation, physical activity and academic success (Barr-Anderson, 2010). The group surveyed a set of middle school and high school kids to determine whether sports participation, physical activity, or a combination of the two were the cause of greater academic success in the students (Barr-Anderson, 2010). The study found that both team participation and physical activity were each independently associated with higher Grade Point Averages (Barr-Anderson, 2010). This study relates to the current investigation because it compares two variables, independently and combined, to academic success.

Similar to this research, previous studies have found that higher physical activity levels are associated with greater academic achievement among students. Unfortunately, few studies have been conducted on individuals after the high school level. In 2009, The Journal of Physical Education, Recreation, and Dance conducted a study in which they compared academic findings in middle school students to undergraduate college students (“Physical Activity”). In both cases, physical activity had a positive effect on test scores as well as overall GPA. The results showed that college students who participated in vigorous physical activity seven days a week had a 0.4 point higher GPA than students who did not participate in physical activity (“Physical Activity”). The study took into account all other variables that might correlate with GPA including gender, race, study time, participation in athletics, and major (“Physical Activity”). With all of these variables accounted for, physical activity was still associated with better academic performances (“Physical Activity”). The current investigation will account for similar confounding variables.

In a study conducted by John E. Skibo, researchers examined the affects aerobic activity has on academic achievement (Skibo, 2008). In the study, college students attending a four year institution were surveyed. The survey asked students to record if they participated in aerobic exercise (Skibo, 2008). Those numbers were then compared the GPA of the students (Skibo, 2008). The results demonstrated a positive correlation between students who participated in aerobic exercise and their GPA (Skibo, 2008). This study demonstrates that aerobic activity does have an effect on college academics.

Although more studies are being conducted on the relationship between academic achievement and physical activity, there are still gaps in the research. Previous research has shown a relationship between academic outcomes and physical activity; however, it is has yet to be determined if the type of physical activity that the individual engages in has a greater impact on their academic outcomes. Running, jogging, Zumba, dance, weight lifting, yoga, and sport are all forms of physical activity. This research will break these categories down into two groups, aerobic and anaerobic exercises, to determine which form of physical activity is most beneficial to an individual's academic achievements. This investigation will look to determine whether improved GPA scores are a result of aerobic exercise, anaerobic exercise, or a combination of both.

### **Method**

The current investigation was designed to expand on the previous research on the relationship between academic achievement and physical activity. For this study, the type of physical activity will be separated into three categories: aerobic exercise, anaerobic exercise and a combination of both aerobic and anaerobic exercise. Aerobic exercise is any activity that

increases the need for oxygen. Therefore, the group will include the activities of running, jogging, biking, swimming, dancing, Zumba, and any sport that incorporates these exercises (Skibo, 2008). Anaerobic exercise is an activity that focuses on building muscle and does not use much oxygen in the body. The activities in this group will include weightlifting and bodybuilding. The final group will consist of individuals who dedicate time to both forms of exercise (Barr-Anderson, 2010).

The target sample group for this study was undergraduate college students. A Cross Sectional Design was used for the collection of the data. Cross Sectional Designs take a sample from a larger population of interest (Gratton & Jones, 2010). In this case, research was abstracted from undergraduate students attending St. John Fisher College in Rochester, New York. The current undergraduate population at the college includes 2,878 students, of which 40.8% are female and 59.2% are male (sjfc.edu). Based on the subgroups within the population, students were contacted via e-mail that included a brief description of the research topic and the survey link. The survey was distributed to all undergraduate student email accounts during the last week of February 2011. In order to establish enough power and confidence in the findings, the study was hoping to analyze 10% to 15% of the undergraduate population, or approximately 350 students. At the end of March, 479 students responded to the survey (16.6% response rate) before it was closed.

The students who participated in the research were analyzed through the use of the survey. The survey was created and distributed electronically through the surveying tool Qualtrics. Among the questions in the survey, students were asked to self assess their weekly hours of physical activity, type of exercise (aerobic, anaerobic, or both) and their academic grade point average (GPA). The survey also accounted for several confounding variables that may have

influenced the study's results. Such variables included gender, major, job or internship, sport team participation, individual ability, and year rank (i.e. Freshman). By asking these questions, it can be determined whether the variables had any effect on the data.

The survey was distributed through e-mail to all undergraduate students regardless of their class rank, gender, or race. These variables were taken into account during the survey process. Students who did not participate in any physical activity were able to list their GPA for the survey. This information was used as an academic achievement comparison to the other three categories of exercise.

The data collected was measured and interpreted using the SPSS statistical software program. The type of physical activity was compared GPA using the correlation statistical tool to determine if it had any effect on GPA. The confounding variables previously mentioned were also compared with student's GPA to determine the affect they had on the results. Finally, the GPA of students who participated in exercise was compared with the GPA scores of students who do not participate in exercise to determine if physical activity affects GPA in St. John Fisher College Students (Gratton & Jones, 2010).

## **Results**

As of late, much research has been conducted to determine the psychological affects that physical activity has on individuals. A number of recent studies have found that physical activity does have a positive effect on student's academic outcomes (see Barr-Anderson, 2010; Caputo, 2009; Carr, 2009). The studies were conducted on elementary, high school, and college students. In each study, it was determined that the students who participated in physical activities had higher grades and test scores than those who did not participate. Additionally, the study

published by The Journal of School Health found that aerobic activity translated to higher academic scores of students (Skibo, 2008).

For this study, I expected to find comparable results to similar studies previously conducted. Instead, I found a weak correlation between not only the type of physical activity and academic success but participation in physical activity and academic success. The research contradicted the results of the previous studies on the topic.

Although the results did not attribute much effect of student's GPA to physical activity, the information did find significance in other variables. Variables that had a strong correlation with student's GPA included gender, hours worked at a job or internship, participation in varsity athletics, and hours spent studying. The variable that had the greatest correlation with GPA was hours spent studying (.001). Most would view this information as somewhat obvious; however, it does give evidence that the amount of time spent studying will positively affect college students GPA. Another strong correlation came from comparing GPA to participation in varsity athletics at St. John Fisher College (.008). Through the data it was determined that students who participated in varsity sports had a slightly lower GPA compared to students who did not (0.3). The greatest correlation that was found in this research was that of gender and physical activity (.000). It was found that the majority of women at St. John Fisher College participate in aerobic activity. Although this information was not the main objective of the research, this knowledge can still be used when developing exercise programs for college women.

Implications in the research results could be attributed to several limitations. The student population of St. John Fisher College is small compared to the average four year institutions. With a larger sample size, there could have been a greater variance in results. Also, the students

who participated in the online survey are likely to be intelligent and involved individuals. The majority of the survey participants had a GPA of 3.0 or higher (4.0 scale). Therefore, there was not much variance in academic scores either. If the survey was distributed differently, the results are likely to have differed from the current results. Lastly, the timing of the survey distribution could have affected the result outcomes. Surveys were delivered to the students before the college had their Spring Break. The majority of the student population probably did not check their email or ignored it completely. These are all implications that researchers should account for if they are to take on a similar study in the future.

### **Implications for the Field**

Health professionals and educators have long believed that a positive relationship exists between physical activity and academic performance (Kolody, 1999). However, it wasn't until recently that researchers were able to determine the effects. Although more studies are being conducted on the relationship between academic achievement and physical activity, there are still gaps in the research. Determining the effects that each type of exercise has on academic outcomes of students will only add to the current body of data and further our knowledge.

The knowledge that this investigation attempted to uncover could benefit a wide variety of individuals. Recently, many schools have reduced physical education opportunities and some grade schools have eliminated recess in order to dedicate more class time toward state mandated tests (Lavall, 1984). Likewise, most colleges and universities do not require students to participate in physical education classes. For those reasons, it is not surprising that our society is faced with the issue of obesity. However, the data that could be gained from similar investigations could influence grade schools and colleges to incorporate physical activity back

into the educational system. Also, by knowing the effects that each type of exercise has on an individual's academic success, instructors or trainers can concentrate on that physical activity recognizing how the student will benefit from it. The students would benefit from not only a health aspect, but an academic aspect as well. Adults not attending college may look to this research as well. It is harder to measure brain capacity without testing; yet, it can be assumed that exercise would have similar psychological effects on an adult as it would a college student.

Schools and their students would be the biggest beneficiary of the current research. If student's grades improved as a result of exercise, the student and the institution profit. The impact of reestablishing types of exercise in the education system may also affect the obesity rates in our society. On the whole, exercise can improve a person's overall quality of life.

Moving forward, more research should be conducted on the subject to gain more knowledge and strengthen the credibility. The investigation did not get the expected results but further data should be conducted on the subject. From this research, future studies may look to determine how each individual exercise affects a student's GPA (i.e. running, dancing, and swimming). The more generalized the data becomes, the more we will understand the effects of physical activity.

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## Appendix

## 1. Dear St. John Fisher College Student,

We are requesting your cooperation in completing the enclosed survey regarding the types of physical activity and academic success. The survey should take no more than five minutes to complete.

We will obtain useful information from this survey for the continuing review of psychological benefits of physical activity. The survey results will be made available to our academic departments and colleges, and to other units and individuals who can use the data for related purposes.

The confidentiality of the data you provide is a vital concern to the Department. At no time will the results compiled from the survey be identified with the individual students.

Thank you for your willingness to assist in this important survey. We value your participation. If you would like to provide comments to the research directly, please feel free to contact me at the e-mail address below.

Sincerely,

Ryan Enos  
Sport Management Major  
rre07429@sjfc.edu

## 2. Dear Student,

Please take the time and complete this survey about the Sport Management Club. We value your input and information. We thank you for your time in completing this survey.

What is your academic year?

- Freshman
- Sophomore
- Junior
- Senior

Are you a transfer student?

- Yes
- No

What is your major?

- Business
- Pharmacy
- Nursing
- Education
- Other

Gender:

- Male
- Female

Do you participate in physical activity?

- Yes
- No: please go to question 8

What activity do you participate in?

- Aerobic
- Anaerobic
- Both Aerobic & Anaerobic

How many hours per week do you dedicate to physical activity?

- Less than 1
- 1 to 3
- 4 to 6
- 7 to 10
- More than 10

Do you have a paid job or internship?

- Yes
- No

How many hours do you work during the week?

- Less than 5
- 5-10
- 11-15
- 16-20
- 21-30
- More than 30

How many hours per week do you dedicate to school work/studying for exams?

- Less than 1
- 1 to 5
- 6 to 10
- 11 to 15
- 16 to 20
- More than 20

What is your accumulative GPA?

- Less than 2.0
- 2.0-2.5
- 2.5-3.0
- 3.0-3.5
- Greater than 3.5

Thank you for your feedback.

If you have any comments or concerns about this survey please contact:

Ryan Enos (rre07429@sjfc.edu) or

Dr. Emily Dane (edane@sjfc.edu)