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Relationships Between Diet, Exercise and Learning in the Regular Science Classroom Setting

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RELATIONSHIPS BETWEEN DIET, EXERCISE, AND LEARNING IN THE REGULAR SCIENCE CLASSROOM SETTING

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RELATIONSHIPS BETWEEN DIET, EXERCISE, AND LEARNING

IN THE REGULAR SCIENCE CLASSROOM SETTING

JOSEPH R. SIERACKI

Abstract

The purpose of this study is to examine how diet and exercise relate to student achievement and learning in the regular classroom setting. Research questions include whether or not there is a positive correlation between the amount/type of exercise a student receives per week and learning, as well as relationships between their diet and learning in the classroom. Forty high school honors biology students were surveyed as to their dietary and exercise habits. This data was compared to their individual average test grades as a measure of learning.

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CHAPTER I

INTRODUCTION

In a nation that is continuously plagued by increasing levels of obesity, more and more children are developing unhealthy habits in their formative years that follow them for the rest of their lives. According to the American Psychological Association, "an estimated 1 in 3 children are overweight and about 1 in 6 (ages 6-17) are obese, and only 30% of children (aged 6 to 17) participated in 20 minutes plus of vigorous physical activity on a daily basis" (American Psychological Association, 2013). Some of these problems will later develop into serious health concerns, which is why it is so important that young adults learn to eat healthy and exercise regularly early on.

Many children have basic understanding of what constitutes physical activity, and what calories are. Very few, however, have any concept at all of how much they should eat, or the types of foods that are healthy (Moreno, 2004). These types of misconceptions could be major contributors to obesity levels and the overall health of young adults. If

students are not learning about basic concepts related to diet, nutrition and exercise early in their academic careers, they might begin forming bad dietary habits that could stick with them for the rest of their lives. The sooner students are exposed to information relating to food and fitness, the better chance they have of developing healthy lifestyles.

To further complicate matters, many schools face funding issues in which one of the first programs that they look to cut are the physical education programs. Decreasing student activity levels throughout the school day (and overall), can have numerous effects on the learning environment of that school. Students may also exhibit increased levels of disciplinary referrals (Sibley, 2008). These types of student behavioral issues are factors that school administrators can control by promoting healthy diet and exercise habits among the student body. In turn, students can expect increased levels of performance, and more positive interaction throughout their school day.

Many schools provide students access to fitness facilities. Many athletes, however, are likely training for their respective upcoming sports, or trying to stay in shape during the offseason. Very few students use the equipment solely for health purposes, so beyond the obvious benefits of a healthy diet and lifestyle, in this study I intended to explore what effect these factors may play on student learning and tests scores. It is said that a healthy body makes for a healthy mind, and thus it was hypothesized that this study would reveal a positive correlation between classroom performance and healthy lifestyle choices. It was expected that children who do not receive a sufficient amount of exercise and healthy foods would demonstrate decreased learning in the classroom and overall decreased test scores. Investigating the relationship between diet, exercise, and learning will improve our knowledge about any potential

scholastic benefits of being active and eating healthy, which will allow parents and students to make better informed decisions.

The purpose of this study was to investigate relationships between high school students' exercise habits and diet and their classroom learning. The research questions were: (a) Is there a correlation between the amount of exercise a student receives per week and their learning in the classroom? (b) Does the type of exercise (flexibility/aerobic/anaerobic) a student participates in relate to achievement levels? (c) Is there any relationship between the types of foods students consume before class and their science test scores? (d) Does the frequency at which a student eats prior to class have any relationship to how students perform on science tests? (e) Does whether or not a student participates in sports relate to their class performance?

CHAPTER II

LITERATURE REVIEW

There have been numerous studies showing relationships between diet, exercise, and brain function. For example, in a study published by *Neuroscience* in 2004, researchers found that exercise had a physiological effect on learning and memory (Molteni, 2004). Researchers used mice to see how exercise improved their learning of a maze. Their experiment showed that exercise had a positive effect on the mice ability to learn the maze, as their memory was actually improved after spending time exercising. While this study does not directly correlate to human learners, it does show that there is a measurable effect that exercise has on learning within the brain. It also showed that exercise could curb the harmful effects of a high-fat diet which was also applied to the mice.

For a great deal of time, researchers had no idea that the growth of new brain cells was possible. It wasn't until recently that scientists discovered that exercise can actually

help. In another study done by the Howard Hughes Medical Institute in 1999, Terrence Sejnowski, (an HHMI investigator at The Salk Institute for Biological Studies), states that exercise can also improve long-term memory. His findings are based on tests that he and his colleagues ran that compared the memory skills of a group of sedentary mice to those of a group of mice who exercised freely on a running wheel for one month, logging an average daily distance of 2.92 miles. They found that the mice that exercised displayed twice as much long-term memory compared to their sedentary counterparts (Van Praag, 1999). These findings were supported by the work done by Molteni and his team.

Diet may be a bigger influence on learning and memory retention on students than educators realize. In a study performed with 396 children in Australia, (ages 6 to 12), who were given a drink with omega-3 fatty acids and other nutrients, (iron, zinc, folic acid, and vitamins A, B6, B12 and C), showed higher scores on tests that measured verbal intelligence and learning and memory after six months and one year than a control group of students who did not receive the nutritional drink. A similar study was also conducted with 394 children in Indonesia. The results showed higher test scores in both boys and girls in Australia, but in only girls in Indonesia (Osendarp, 2007). These studies clearly demonstrate that there is a connection between nutrition and school performance, but they fail to recognize the benefits of exercise. In addition, the study was done in a younger target group than this research project is intended for, which seems to be a reoccurring theme in this type of research. There is a lack of literature about the relationship between nutrition and school performance for students at the high school level.

It is clear that physical activity does not inhibit academic achievement, but few studies have shown that it directly helps or increases performance levels. Researchers conducting a study in Mississippi public schools for children grades 3-8 attempted to make that connection by comparing fitness data to academic achievement and behavior (Blom, 2011). Fitness data was collected using the *Fitnessgram*, which uses six components of health-related fitness to determine overall fitness levels. These components include a progressive aerobic cardiovascular endurance run, curl-ups, push-ups, trunk lifts, sit and reach, and skinfold/Body Mass Index (BMI). Each of these components has a healthy fitness zone, which students are either in or above. If not, they are categorized at below, and thus to not receive a point. Participants can therefore achieve a maximum score of six, stating that they meet or exceed each fitness components healthy zone. Academic achievement was gauged using the Mississippi Curriculum Test for language arts and mathematics, which is administered annually to Mississippi students grades 3-8. Academic behavior was determined by using attendance and disciplinary data on students. The study also took into account socio-demographic information, such as race/ethnicity and whether or not that student qualified for a free or reduced price lunch. The results of the study showed that students who were categorized as "more fit" were less likely to miss school and do poorly on standardized testing (Blom, 2011). In fact, students with the lowest number of healthy fitness zones were over four times as likely as those with the highest to have eight or more absences for the academic school year. A similar trend was formed for achievement levels, with students at the highest number of healthy fitness zones achieving three to four times as high as those

with zero. Disciplinary data, however, showed no significant relationship between test scores or achievement levels.

In another study performed by a Midwest City school district, 800 sixth graders were assessed in nutrition, physical activity, fitness measures, BMI, and academic performance. Fitness assessments included a mile run, curl-ups, push-ups, height/weight, which were then matched with standardized test scores. The results were also compared to meal price status and gender. They showed that higher math scores were associated with better nutrition (more milk and breakfast, less sweetened beverages, etc.), increased physical activity and sports teams, reduced television, and higher fitness levels (better mile run performance). This demonstrates that there is a clear relationship between nutrition, physical activity, fitness, and academic achievement levels, but that meal status (which acts as an indicator of socio-economic status) and gender remain important variables as well (Edwards, 2011).

Parents, teachers, administrators, and even legislators are becoming increasingly aware of the effects that a healthy diet can have on children's education. So much so that, in 2010, President Obama signed into the law the Healthy, Hunger-Free Kids act. This act provides free school means to children in need, and further more acts to make sure that all school foods sold have nutritious choices. This historic act has already directly affected many schools by making sure that they include more fresh produce and who grains with less sodium and added sugar (Rice, 2011). It is not enough that kids eat breakfast and lunch; they must eat healthy choices provided to them by their school, and that's exactly what the Healthy, Hunger-Free Kids act ensures. Despite this monumental

shift in values about healthy alternatives, schools can still do more to for their students to promote a healthy lifestyle and increase student achievement levels.

While this literature review supports the hypothesis that diet and exercise are positively related to learning, there was no research found that draws a direct connection between each variable and high school-level student learning in science. While diet and exercise have been shown to promote improved memory retention, cognition, and improved test scores, this research study will address these issues in the context of the regular science classroom setting.

2.1 Rationale

As demonstrated by the literature review, there is much information about the positive effects that diet and exercise have on learning. There is not, however, information as to how diet and exercise can directly affect students in regular science classrooms. This is especially true of the high school level, as much of the literature pertains to younger students. Information obtained from this research directly benefits students by informing them of factors outside of the classroom that affect their performance and achievement levels.

CHAPTER III

METHOD

3.1 Research Design

This research study was primarily quantitative with a correlational design and information collected through surveys. The surveys were also be used to collect some qualitative responses that were used to better inform the quantitative analysis and results. The purpose of the research was to determine if there is a relationship between high school students' exercise and diet and their learning, as measured by in-class science test scores. The independent variables are amount and type of exercise, and frequency and type of food consumption, and the dependent variable is science test scores/achievement. Students also completed a survey as to how they think diet and exercise affects their classroom performance to provide qualitative data. The hypothesis of this study was that students with healthier diets and regular exercise will perform better on science tests than

the students with poor diets and little exercise. This was determined using a correlational research design, with qualitative data contributing to the interpretation of the results.

3.2 Sample

A convenience sampling method was used to recruit participants for this study. The researcher is a high school science teacher, and participants were all willing students from among his two honors biology classes. These classes consist of 40 honors students, who voluntarily completed surveys about their normal dietary and exercise habits. These two classes were chosen because all students in these classes are close to the same age and the tests will be the same, which allows for the control of other variables.

The students in the researcher's classes consist of 1.2% black, non-Hispanic, 2.5% Asian or Pacific Islander, 1.2% Hispanic, 2.0% Multi-Racial, 92.8% White, non-Hispanic, 13.4% economically disadvantaged, 1.3% limited English proficient, and 9.3% students with disabilities (Ohio Graduation Test, 2011). The school has exhibited varying degrees of OGT science proficiency above state standards over the past three years (2007-2010), in both 10^{th} and 11^{th} graders taking the test. In the 2007-2008 school years, 10^{th} graders recorded a pass rate of 89.2%, with 11^{th} graders at 96.7%. In the 2008-2009 school year, 10^{th} graders recorded a 95.6%, while 11^{th} graders a 97.3%. Finally, in the 2009-2010 school year, 10^{th} graders passed at 90.7%, and 11^{th} graders 97.4%. The state standard is a 75% pass rate for 10^{th} graders, and 85% for 11^{th} graders (Ohio Graduation Test, 2011).

Although these percentages may seem as if there is very little room for improvement, upon further review the number of students who scored at the "advanced"

level did not exceed 41.7% for the 2009-2010 school year (Ohio Graduation Test, 2011). Even fewer students scored at the "accelerated" level, which is a step below "advanced." This demonstrates a need for deeper comprehension of science for students at every demographic.

3.3 Instruments

Students completed a survey about their typical diet and exercise habits (Appendix A). This survey was adapted from "The Adolescent Food Habits Checklist (Johnson, 2002)," which had an internal reliability of 0.82. This study also examined convergent validity, establishing strong correlations between each variable studied. To supplement the survey results, each student also provided responses to open-ended questions at the end to help inform the researcher of anything that was not considered on the survey.

In addition to reporting general information about exercise on the survey, participating students were asked to maintain an exercise log (Appendix B) over a period of one week. Students recorded exactly the types of exercise activities that they participated in, as well as the times and amounts in order to better evaluate their activity level. To measure learning, an in-class science test was given during the time period in which they were keeping their exercise logs. These test scores were then used to determine if there is any correlation between the variables, along with their current class grade and overall class grade.

3.4 Procedure

To begin this research study, IRB consent was obtained from Cleveland State University. Permission was sought from both students and their parents, and both were informed that this is not a required class activity and will not affect their class standing. Confidentiality of student data was maintained, and no names were used in the research study. The researcher was also blind to student's identities by assigning each student an ID number in order to correlate their data. Once consent was given, the researcher began by instructing students to keep an exercise log over the course of a one week period. Students recorded their exercise routine during that time. Students also specified the type of exercise performed and the duration each day. Student's average science test scores were then used to determine if there is any relationship between the variables. Students were also asked to complete a survey to comment on their feelings towards how diet and exercise affects their classroom performance and to give some general information about their diet and exercise, to help ensure the reliability of the logs and survey (Appendix C). The survey took approximately 15 minutes to complete, and was done immediately after the assessment.

3.5 Data Analysis

For research question (a) Is there a correlation between the amount of exercise a student receives per week and their learning in the classroom, the researcher looked for correlations between number of hours of exercise per week reported on the survey and test scores taken from a unit test taught over a two week period. On research question (b) Does the type of exercise (flexibility/aerobic/anaerobic) a student participates in relate to

achievement levels, three separate correlations between frequency of participation in each type of exercise and test scores were used. For research question (c) Is there any relationship between the types of foods students consume before class and their science test scores, types of foods students consume was used to group students into categories. Then, One-way Analysis of Variance (ANOVA) with independent variable type of food and dependent variable test score showed relationships between type of food and science test score outcomes. On research question (d) Does the frequency at which a student eats prior to class have any relationship to how students perform on science tests, a correlation between frequency (how often a student eats breakfast or lunch) and test scores was used. Finally, for research question (e) Does whether or not a student in involved in sports relate to student class performance, survey data on sports participation was examined. Then, the researcher looked for a correlation between participation and test scores.

CHAPTER IV

RESULTS

The research questions were: (a) Is there a correlation between the amount of exercise a student receives per week and their learning in the classroom? (b) Does the type of exercise (flexibility/aerobic/anaerobic) a student participates in relate to achievement levels? (c) Is there any relationship between the types of foods students consume before class and their science test scores? (d) Does the frequency at which a student eats prior to class have any relationship to how students perform on science tests? (e) Does whether or not a student participates in sports relate to their class performance?

When the students' reported weekly exercise hours were cross-referenced with their total hours of exercise from the exercise logs, there was a strong, significant Pearson Correlation value, $r(38) = .583$, $p = 0.000$. This supports the reliability of the reported average hours of exercise, since it shows that students reported consistent numbers between the two methods of recording.

For research question (a) Is there a correlation between the amount of exercise a student receives per week and their learning in the classroom, the researcher looked for a correlation between number of hours of exercise per week reported on the survey and test scores taken from a unit test taught over a two week period. The Pearson Correlation value showed that there was no correlation between total hours of exercise and the last test score percentage, $r(38) = -0.046$, $p = 0.389$. The significance also showed that the null hypothesis is maintained.

To further investigate this research question, there was a weak Pearson Correlation value between reported average hours of exercise per week and the last test score, $r(38) = .239$, $p = .137$. This demonstrates no significance between the mean test score of the last test and reported weekly exercise hours, (see Figure 1). There was also nothing outstanding on the open-ended questions with no discernible patterns. Some responses did, however, help to support the results and inform.

For research question (b) Does the type of exercise (flexibility/aerobic/anaerobic) a student participates in relate to achievement levels, three separate correlations between frequency of participation in each type of exercise and test scores was used. Data compiled from student exercise logs produced results that included the amount of time they spent on each of the following: high cardiovascular activity (aerobic), strength training (anaerobic), and yoga (flexibility). The Pearson Correlations show that there is no correlation between hours of flexibility related exercise, $r(38) = -.039$, $p = .810$, aerobic exercise, $r(38) = -.070$, $p = .667$, or anaerobic exercise, $r(38) = .104$, $p = .524$ and scores on the last test.

For research question (c) Is there any relationship between the types of foods students consume before class and their science test scores, the types of foods students consume was determined from the diet and exercise survey. Then, One-way Analysis of Variance (ANOVA) with the independent variable type of food and dependent variables test scores, current class grade, and overall class grade were each used to look for relationships between type of food and science achievement outcomes. Questions were categorized as either healthy or unhealthy options. Question number one asked students if they are having lunch away from home, do they often choose a low-fat option. Students could respond with a true, false, or that they never have lunch away from home. True responses and never eating lunch away from home were counted as a healthy option, while false were counted as an unhealthy option. A one-way between subjects ANOVA the relationship between choosing a low-fat option on test scores, current class grade, and student's overall grade in the class in true, false, or never eating lunch away from home conditions. There was a significant relationship between choosing a healthy option on current [$F(1, 38) = 5.10$, $p = .030$] and overall [$F(1, 38) = 4.15$, $p = .049$] class grades at the $p < .05$ level for the three conditions, (see Table 1). Choosing the healthy option was associated with higher grades.

Question number five asked students if they tried to keep their overall fat intake down. Students could respond with a true or false. True responses were counted as a healthy option, while false were counted as an unhealthy option. A one-way between subjects ANOVA compared the relationship between keeping overall fat intake down on test scores, current class grade, and student's overall grade in the class in true or false conditions. There was a significant relationship between keeping overall fat intake down

on current [F (1, 38) = 7.39, p = .010] and overall [F (1, 38) = 6.95, p = .012] class grades at the $p < .05$ level for the two conditions, (see Table 2). Choosing the healthy option was associated with higher grades.

Question number seven asked students if they avoid eating a lot of sausages or burgers. Students could respond with a true, false, or that they never eat sausages or burgers. True responses and never eating sausages or burgers were counted as a healthy option, while false were counted as an unhealthy option. A one-way between subjects ANOVA compared the relationship between eating a lot of sausages or burgers on test scores, current class grade, and student's overall grade in the class in true, false, or never eating sausages or burgers conditions. There was a significant relationship between choosing a healthy option on current class grades [F (1, 38) = 4.87, p = .034] at the $p < .05$ level for the three conditions, (see Table 3). Choosing the healthy option was associated with higher grades.

Question number eight asked students if they often buy cookies or cakes. Students could respond with a true or false. False responses were counted as a healthy option, while true were counted as an unhealthy option. A one-way between subjects ANOVA compared the relationship between often buying cookies or cakes on test scores, current class grade, and student's overall grade in the class in true or false conditions. There was a significant relationship between choosing a healthy option on the last test grade [F (1, 38) = 4.49, p = .043] at the $p < .05$ level for the two conditions, (see Table 4). Choosing the healthy option was associated with higher grades.

Question number ten asked students if they eat at least one serving of vegetables or salad per day. Students could respond with a true or false. True responses were

counted as a healthy option, while false were counted as an unhealthy option. A one-way between subjects ANOVA compared the relationship between eating at least one serving of vegetables or salad per day on test scores, current class grade, and student's overall grade in the class in true or false conditions. There was a significant relationship between choosing a healthy option on the last test [$F(1, 38) = 5.21$, $p = .028$] and current class [$F(1, 38) = 6.40$, $p = .016$] grades at the $p < .05$ level for the two conditions, (see Table 5). Choosing the healthy option was associated with higher grades.

Question number fourteen asked students were asked if they often eat sweet snacks or candy between meals. Students could respond with a true or false. True responses were counted as a healthy option, while false were counted as an unhealthy option. A one-way between subjects ANOVA compared the relationship between often eating sweet snacks or candy between meals on test scores, current class grade, and student's overall grade in the class in true or false conditions. There was a significant relationship between choosing a healthy option on current [$F(1, 38) = 5.87$, $p = .020$] and overall [$F(1, 38) = 4.89$, $p = .033$] class grades at the $p < .05$ level for the two conditions, (see Table 6). Choosing the healthy option was associated with higher grades.

Question number sixteen asked students if they are buying a soft drink, do they often choose a diet option. Students could respond with a true, false, or that they never buy soft drinks. True responses and never buying soft drinks were counted as a healthy option, while false were counted as an unhealthy option. A one-way between subjects ANOVA compared the relationship between choosing diet soft drinks on test scores, current class grade, and student's overall grade in the class in true, false, or never buying soft drinks conditions. There was a significant relationship between choosing a healthy

option on overall class grades [F (1, 38) = 5.31, p = .027] at the p < .05 level for the three conditions, (see Table 7). Choosing the healthy option was associated with higher grades.

The results demonstrate that for students who chose healthy diet options for question numbers 1, 5, 7, 8, 10, 14 and 16 on their survey, there was a significant relationship between the independent variable type of food and dependent variable test score, current class grade, or overall grade in class. These questions dealt with a variety of healthy options, including reduced fat options and current/overall class grades, (see Figures 2, 3, and 4). Avoidance of sweets like cookies, cakes and candies also showed a significant relationship with classroom achievement, (see Figure 5). With all of these questions, choosing the healthy option was associated with higher grades. No other questions from the diet and exercise survey showed any significant relationships between variables.

On research question (d) Does the frequency at which a student eats prior to class have any relationship to how students perform on science tests, a correlation between how often students eat meals prior to class and test scores was used. These tests were run separately, correlating first period with whether or not they eat breakfast, and ninth period with whether or not they eat lunch. This was done because breakfast would be directly before first period, and lunch would be right before ninth. The Pearson Correlation value showed no correlation between breakfast eating behavior and scores on the last test, r(19) = -.284, p = .217. This suggests that there is no relationship between tendency to eat breakfast and scores on the science test taking place between breakfast and lunch, (see Figure 6). Likewise, there was no correlation between lunch eating

behavior and scores on the last test, $r(17) = .334$, $p = .156$. Therefore, there is no relationship between tendency to eat lunch prior to class and test scores on a science test taking place after lunch (see Figure 7).

Finally, for research question (e) Does whether or not a student participates in sports relate to their class performance, survey data on sports involvement was examined. The researcher looked for a correlation between involvement or noninvolvement in sports and overall class grade. The Pearson Correlation value showed that there was a weak correlation between whether or not a student participates in sports and their overall grade in the class, but with no significance, $r(38) = -.253$, $p = .116$. This shows that involvement in sports had no significant correlation to overall grades in the class, (see Figure 8).

CHAPTER V

CONCLUSION

At the beginning of this study, the literature review made it clear that a healthy diet and regular exercise regimen can have a number of positive effects in the classroom. These include increased memory retention, superior learning ability, higher test scores, decreased absences, and overall higher achievement levels. This supported the hypothesis that diet and exercise affects learning in the regular science classroom setting. The results of this study, however, were mixed. The fact that there was no significant data obtained from correlating hours of exercise, type of exercise, and any of the achievement indicators leads the researcher to believe that students may have misrepresented the amount of exercise they reported. Especially since they verified these values in the survey.

It is possible that students overrepresented the amount of exercise they performed in order to appear to live a healthier lifestyle, projecting a more positive self-image to

their instructor. If students were to report their results to someone with whom they have no prior relationship, it may encourage more accurate data keeping. It's also possible that students are limited by the number of hours they are able to exercise due to their enrollment in high-level honor's level classes. This could potentially lead to students spending more time on studying and less time on fitness, which could produce higher than normal achievement levels with reduced exercise levels. As one student stated on the Diet and Exercise Post Assessment Survey, "I feel you must work harder to do well when you exercise, especially because while exercising you are losing study time." This could be corrected for using a larger population, and moving outside of honors level classes only.

It is equally possible that there is just not as strong a correlation between exercise and achievement levels in high school science courses. The literature supported the research hypothesis for students at younger grade levels, so perhaps as students mature these factors have less significance in the classroom. Once more, a larger population from which data could be taken could help to better clarify these unknown quantities. A wider and more diverse population could easily help to verify the results of this study, or support the original hypothesis.

While the exercise data did not yield any significant results, the Diet and Exercise Survey did produce some more meaningful data in terms of dietary habits and achievement levels. It can be concluded from the data that the independent variable reduced fat intake and dependent variables current class grade and overall class grade have a significant relationship. Questions one and five from the diet survey in particular yielded interesting results, with students stating that they pursue low-fat options

demonstrating higher class averages. Similarly, questions eight and fourteen both death with students choosing a sweet snack and in both cases students who avoided sweets showed higher classroom achievement. These results indicate that students who are more health conscientious in what they eat may demonstrate higher achievement levels in the regular science classroom setting.

In terms of meal frequency prior to class and test taking no significant data was obtained, just as sports participation led to no meaningful data. This could once more be explained due to the relatively small sample size. A larger population could provide more prominent trends with significance in the data, revealing a need for further research. Based on the results of this research, it is the recommendation of the researcher that more data from a wider population is needed in order to conclude how exercise affects learning and achievement in the regular science classroom setting. The data must also be verified in a more efficient manner than proposed by this study. Perhaps students could be required to have their exercise logs signed-off on by a parent, coach, or some secondary source. This may encourage more accurate reporting of exercise habits, building stronger correlations to classroom achievement.

Certain extraneous variables may have also contributed to the limitations of the research results. For example, socioeconomic status could play a role on the frequency to which students are able to eat prior to class. Although the participants of this study were pulled from a population in which there is a relatively low percentage of economically disadvantaged students, it could still affect meal frequency, types of food consumption, sports participation, and access to fitness equipment.

Parental involvement may be another confounding variable, having an effect on the independent or dependent variables. For example, it's possible that a student who receives a greater amount of parental involvement may also be more likely to eat prior to class and receive help with school, thus demonstrating higher levels of achievement in the regular science classroom setting.

The researcher also concludes that a more detailed look at dietary habits is necessary to fully understand how diet affects learning in the regular science classroom setting. While it is clear that students who report higher frequencies of low-fat and less sweet options show higher achievement levels, a more detailed dietary log including calorie content could provide more substantial data and trends. In summation, while this research provides interesting insights into how diet and exercise affect achievement levels in the regular science classroom, more information is needed before any causal relationships can be drawn.

Tables and Figures

Table 1

ANOVA Dietary Question 1 and Classroom Achievement

		Diet Question 1				
		Mean	S	df	F	Sig.
Last Test Score % (4/8)	Healthy	80.27	10.10	(1,38)	.589	.447
	Unhealthy	77.60	10.94			
Current Class Grade %	Healthy	89.80	5.44	(1,38)	5.1000	.030*
	Unhealthy	83.52	9.88			
Overall Grade (pts)	Healthy	23.40	3.92	(1,38)	4.145	.049*
	Unhealthy	20.00	5.69			

Note. * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$.

Table 2

ANOVA Dietary Question 5 and Classroom Achievement

		Diet Question 5				
		Mean	S	df	F	Sig.
Last Test Score % (4/8)	Healthy	80.03	10.01	(1,38)	2.274	.140
	Unhealthy	74.30	11.61			
Current Class Grade %	Healthy	87.93	6.14	(1,38)	7.385	.010**
	Unhealthy	79.70	13.01			
Overall Grade (pts)	Healthy	22.47	4.25	(1,38)	6.951	.096
	Unhealthy	17.70	6.73			

Note. * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$.

Table 3

ANOVA Dietary Question 7 and Classroom Achievement

		Diet Question 7				
		Mean	S	df	F	Sig.
Last Test Score % (4/8)	Healthy	81.00	9.74	(1,38)	2.922	.096
	Unhealthy	75.35	11.09			
Current Class Grade %	Healthy	88.43	5.38	(1,38)	4.865	.034*
	Unhealthy	82.41	11.55			
Overall Grade (pts)	Healthy	22.22	4.42	(1,38)	1.733	.196
	Unhealthy	20.00	6.25			

Note. * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$.

Table 4

ANOVA Dietary Question 8 and Classroom Achievement

		Diet Question 8				
		Mean	S	df	F	Sig.
Last Test Score % (4/8)	Healthy	80.28	9.78	(1,38)	4.392	.043*
	Unhealthy	71.88	11.66			
Current Class Grade %	Healthy	87.25	7.67	(1,38)	4.074	.051
	Unhealthy	80.38	11.94			
Overall Grade (pts)	Healthy	21.84	5.11	(1,38)	1.873	.179
	Unhealthy	19.00	5.86			

Note. * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$.

Table 5

ANOVA Dietary Question 10 and Classroom Achievement

		Diet Question 10				
		Mean	S	df	F	Sig.
Last Test Score % (4/8)	Healthy	79.97	9.87	(1,38)	5.213	.028*
	Unhealthy	69.00	11.49			
Current Class Grade %	Healthy	87.14	7.80	(1,38)	6.395	.016*
	Unhealthy	77.00	12.31			
Overall Grade (pts)	Healthy	21.89	5.06	(1,38)	3.978	.053
	Unhealthy	17.00	5.66			

Note. * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$.

Table 6

ANOVA Dietary Question 14 and Classroom Achievement

		Diet Question 14				
		Mean	S	df	F	Sig.
Last Test Score % (4/8)	Healthy	80.03	9.49	(1,38)	3.683	.062
	Unhealthy	71.86	13.55			
Current Class Grade %	Healthy	87.36	7.45	(1,38)	5.867	.020*
	Unhealthy	78.86	12.44			
Overall Grade (pts)	Healthy	22.09	4.80	(1,38)	4.885	.033*
	Unhealthy	17.43	6.05			

Note. * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$.

Table 7

ANOVA Dietary Question 16 and Classroom Achievement

		Diet Question 16				
		Mean	S	df	F	Sig.
Last Test Score % (4/8)	Healthy	81.29	9.31	(1,38)	1.964	.196
	Unhealthy	76.61	11.21			
Current Class Grade %	Healthy	87.82	5.71	(1,38)	1.416	.241
	Unhealthy	84.43	10.64			
Overall Grade (pts)	Healthy	23.41	3.54	(1,38)	5.305	.027*
	Unhealthy	19.70	5.90			

Note. * = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$.

Figure 1 – Reported Weekly Exercise Hours and Last Test Score

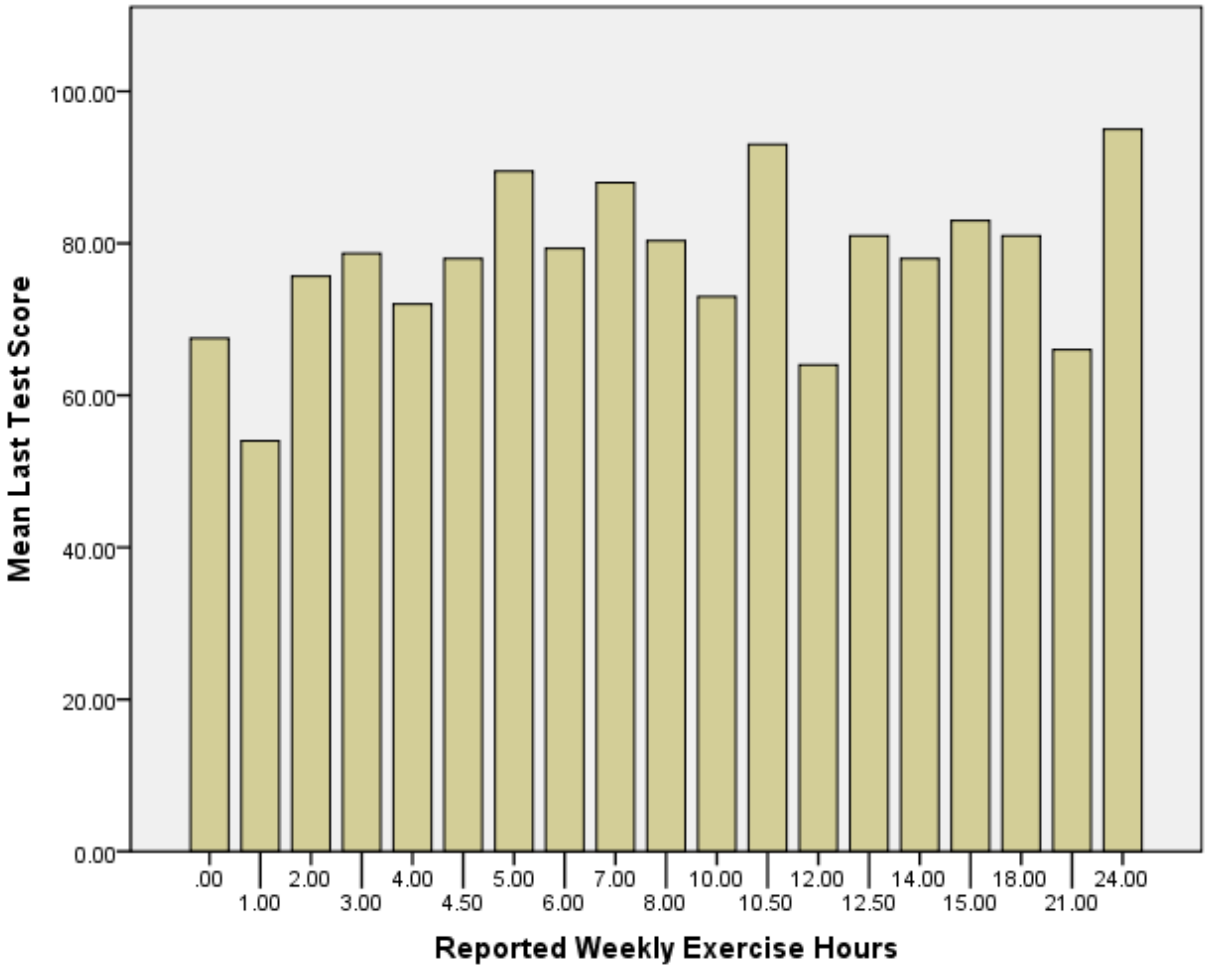


Figure 2 – Dietary Question 1 and Current Class Grade

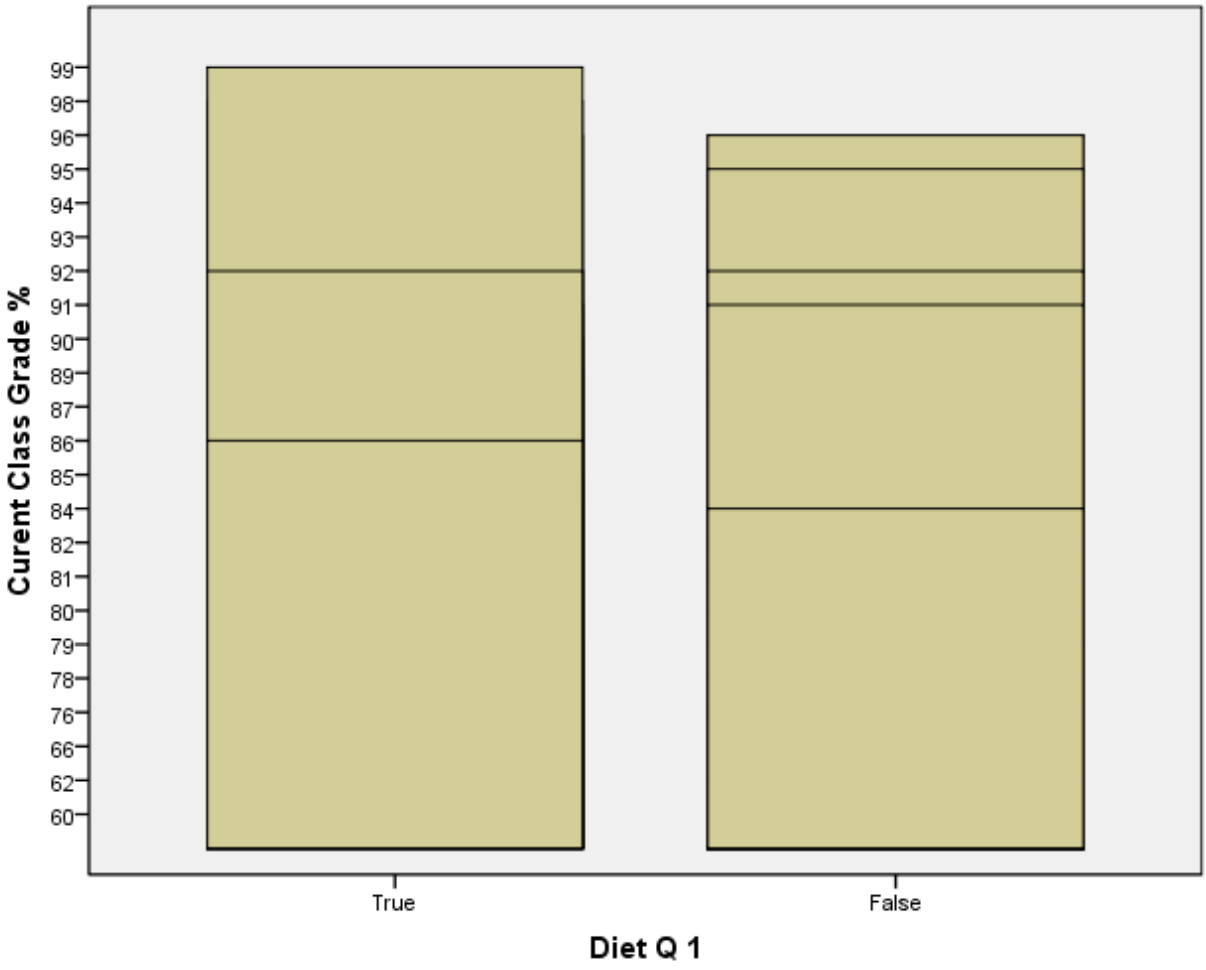


Figure 3 – Dietary Question 5 and Overall Grade

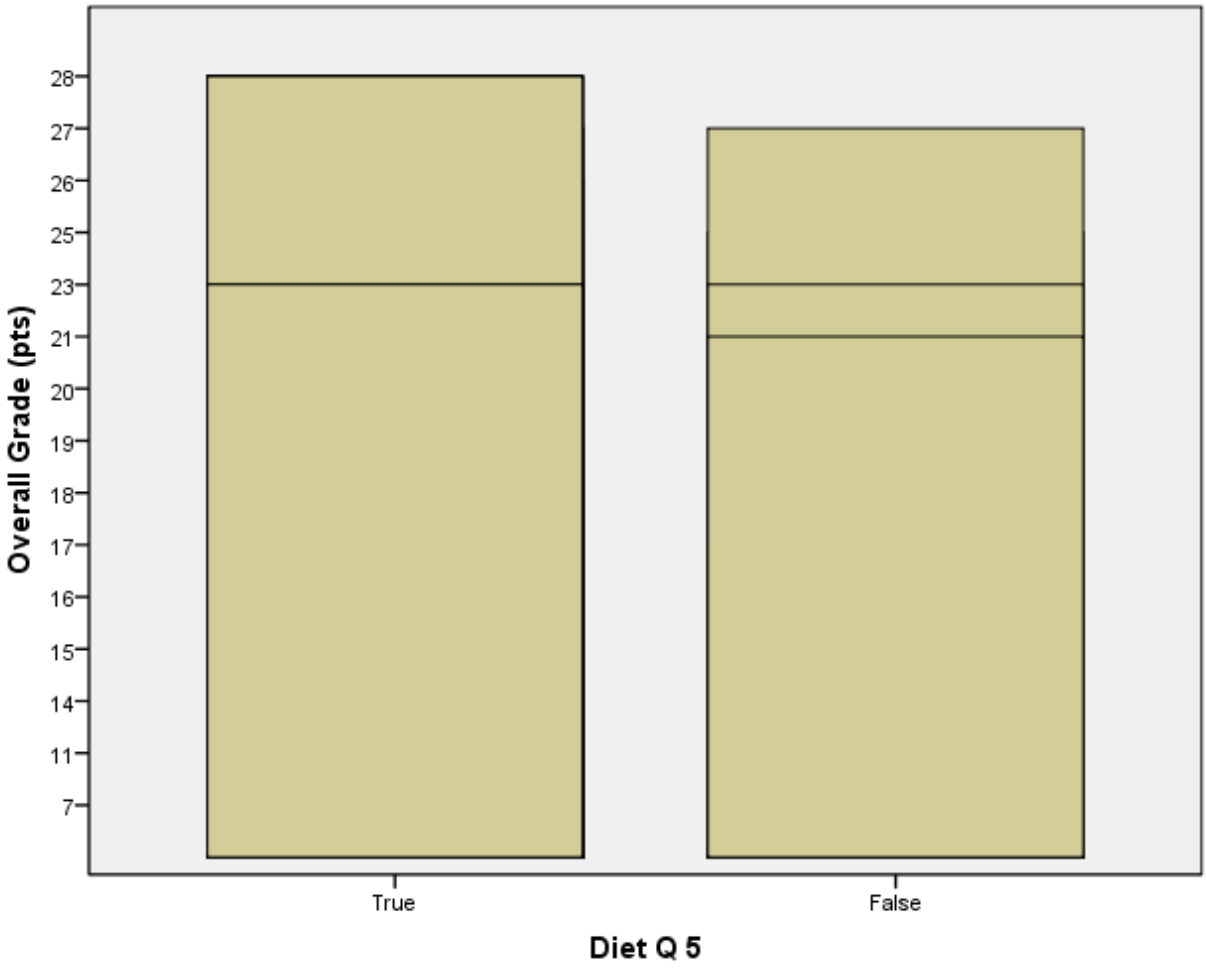


Figure 4 – Dietary Question 5 and Current Class Grade

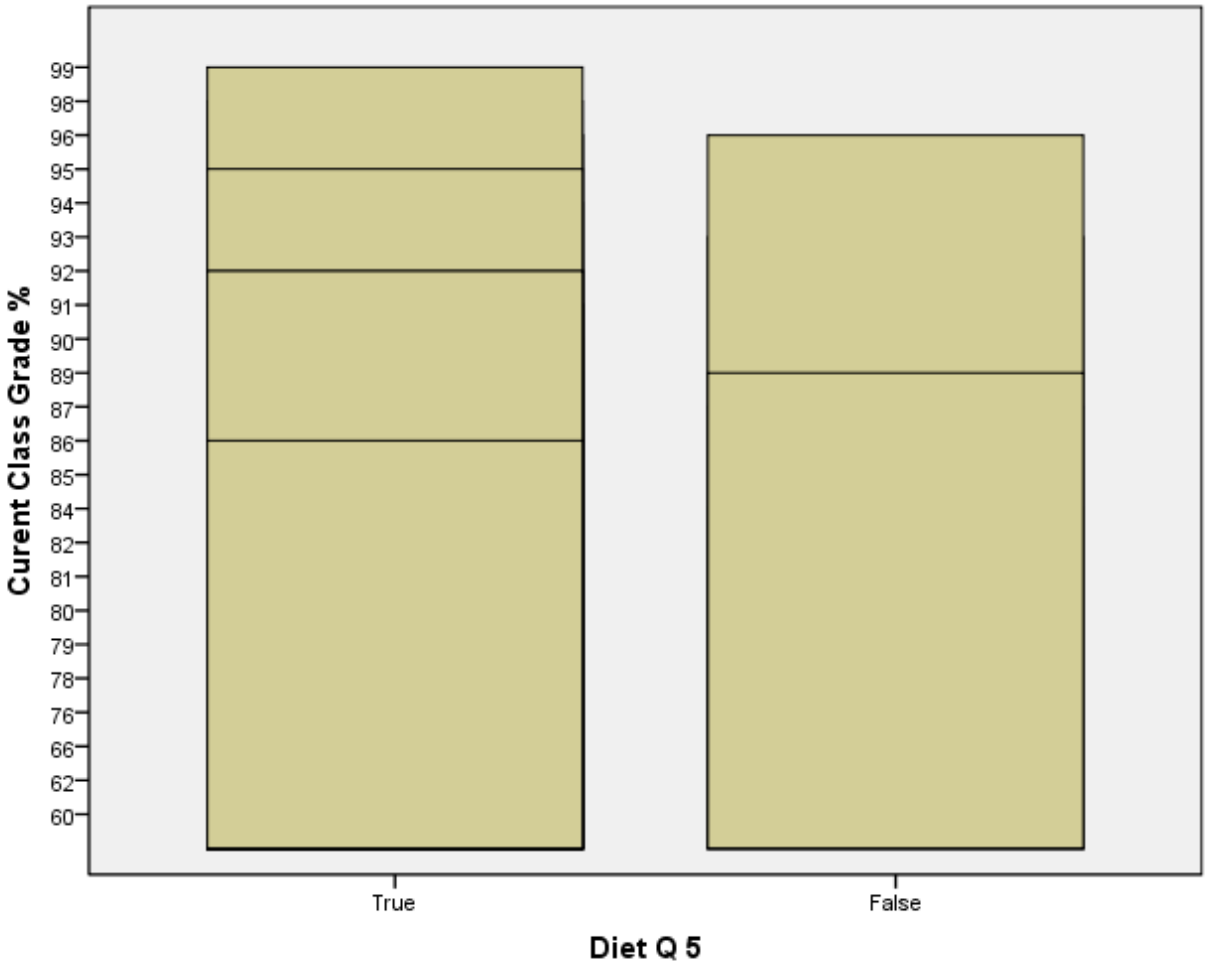


Figure 5 – Dietary Question 8 and Last Test Score

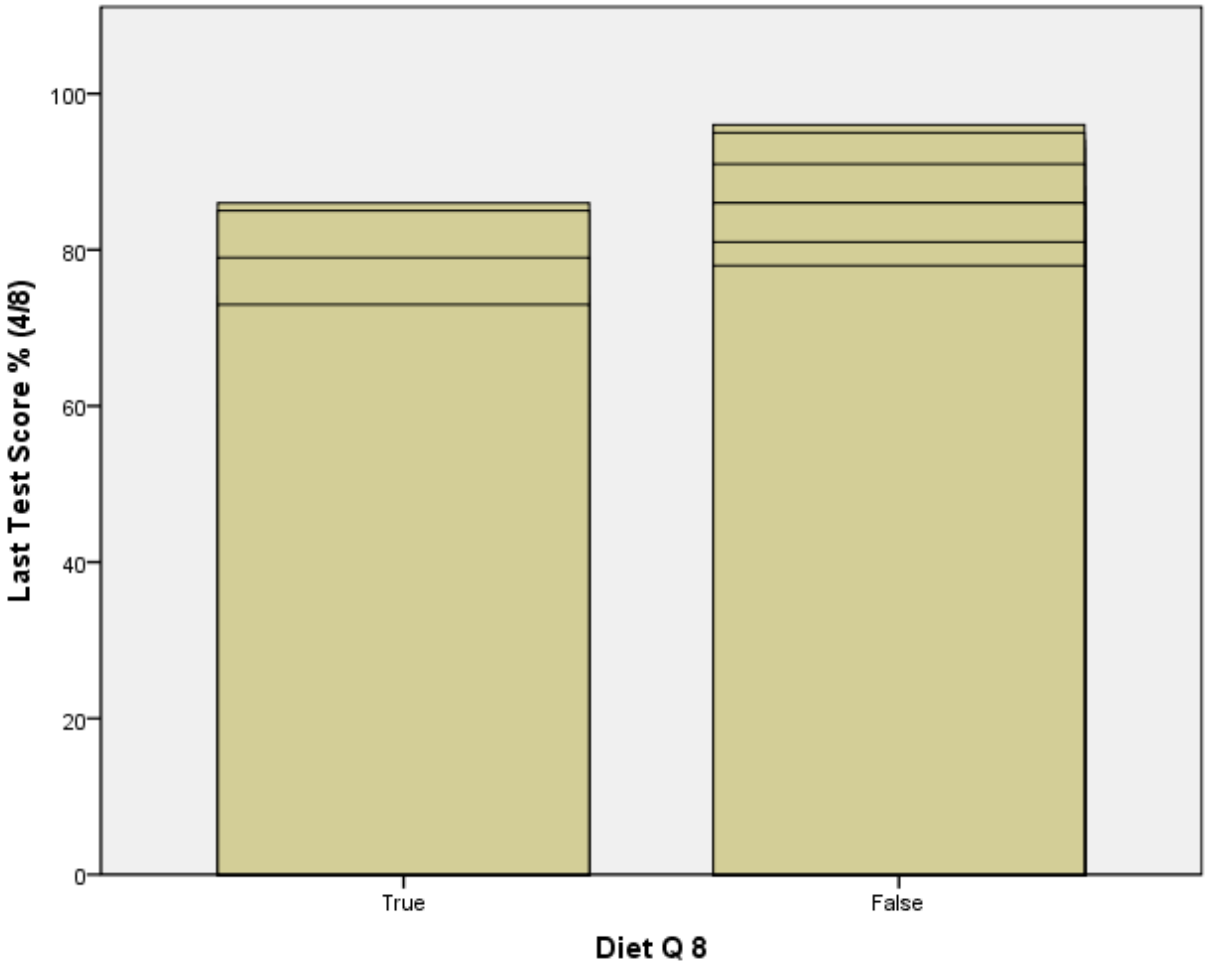


Figure 6 – Breakfast Frequency and Last Test Score

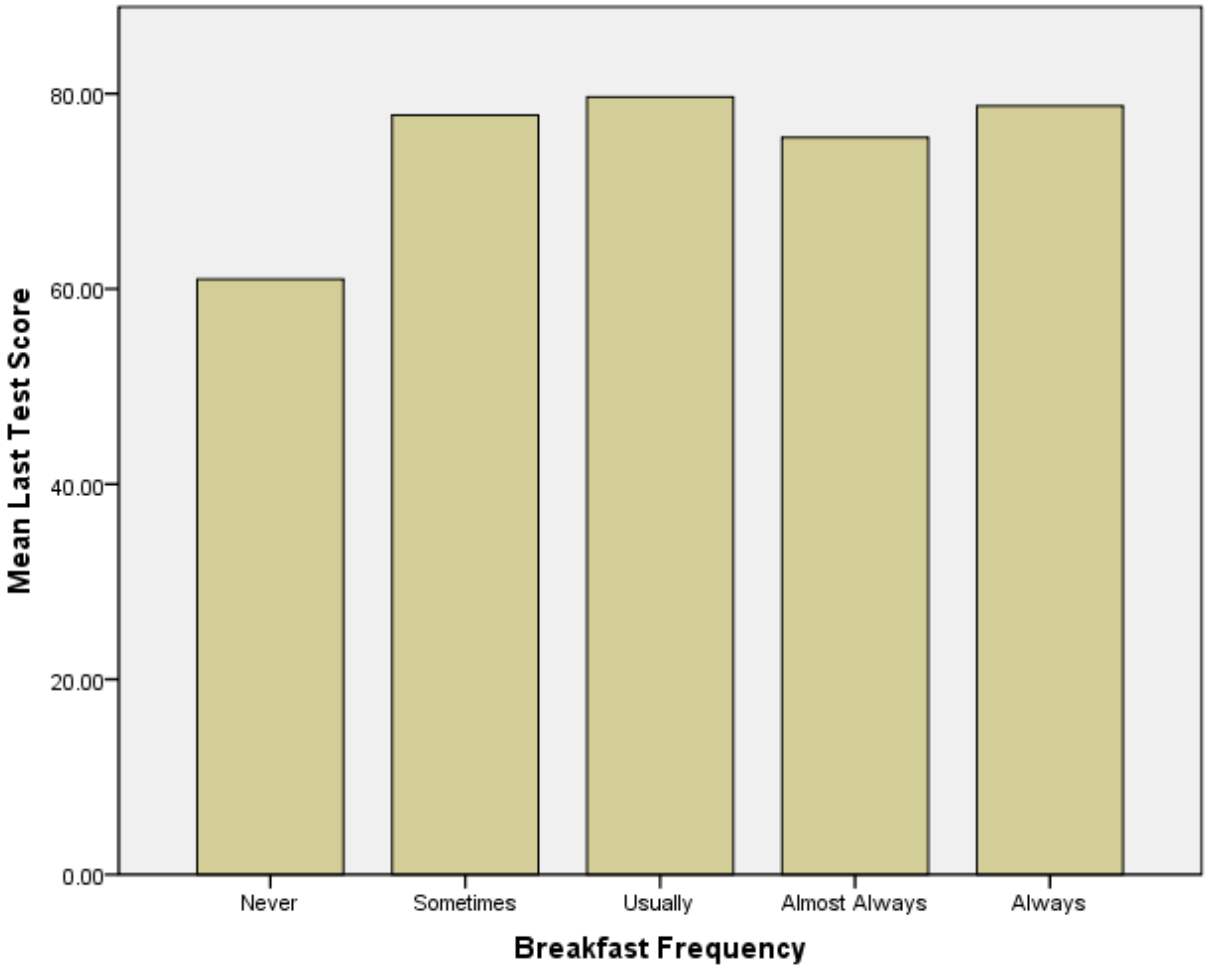


Figure 7 – Lunch Frequency and Last Test Score

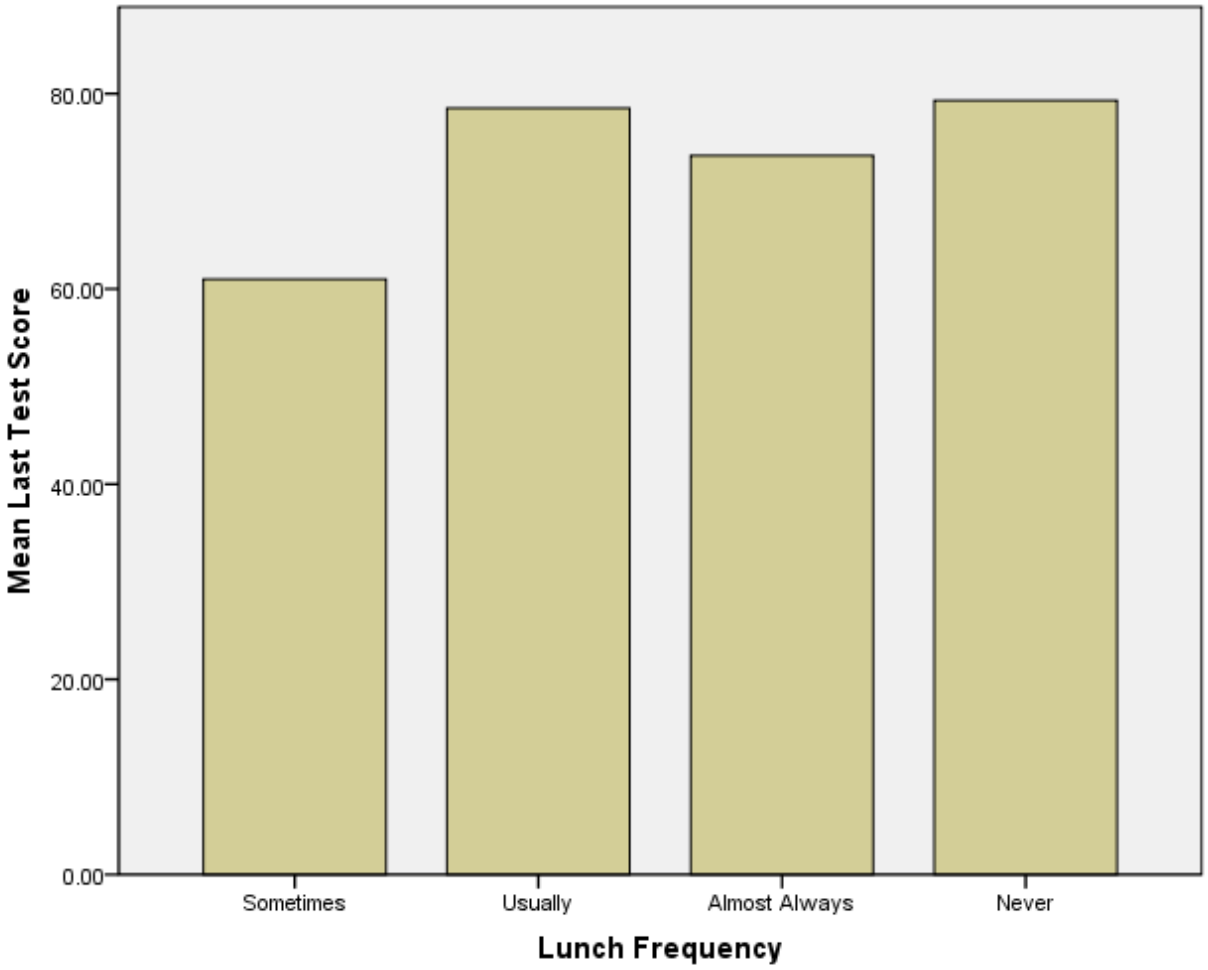
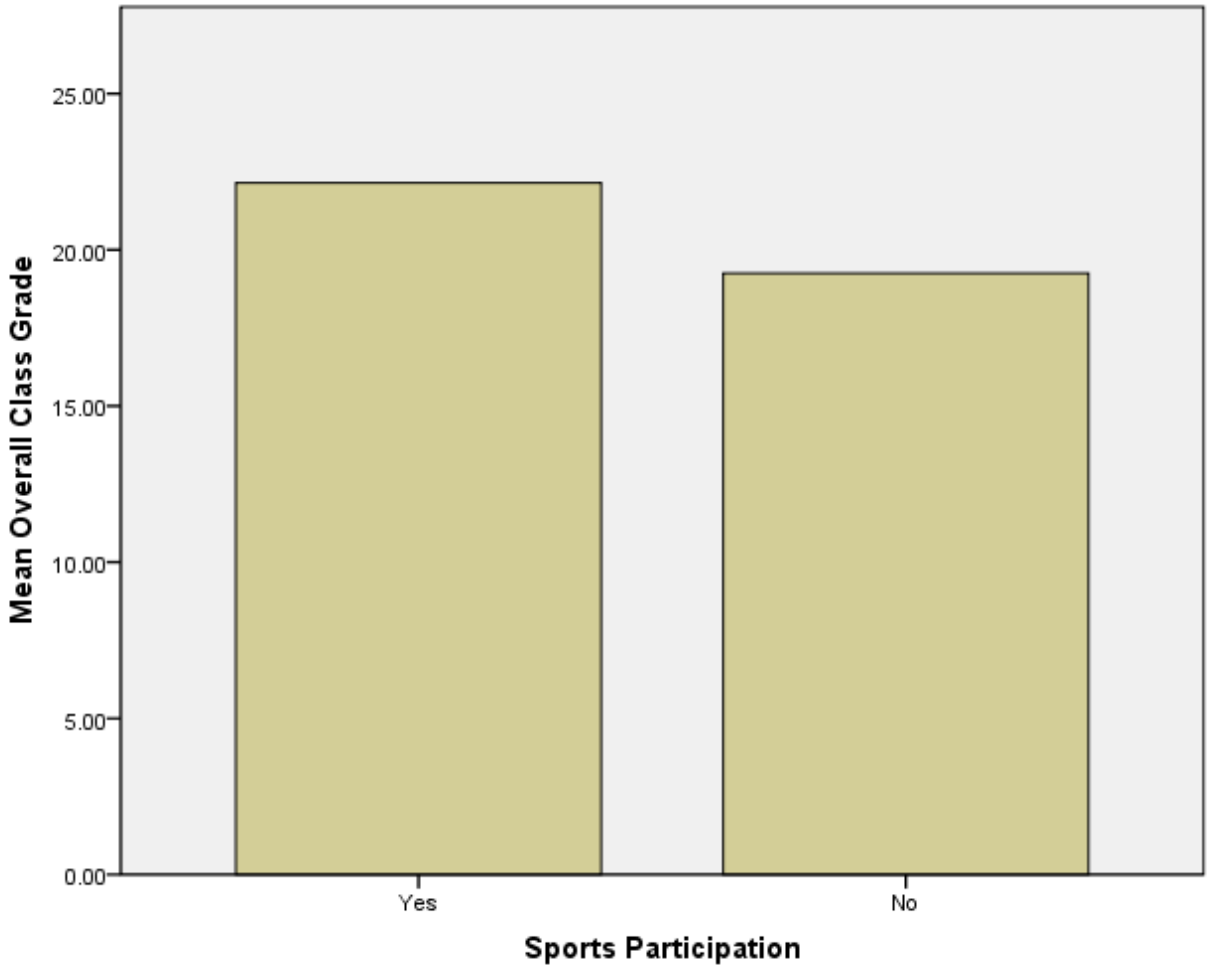


Figure 8 – Sports Participation and Overall Class Grade



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APPENDIX

Appendix A

Name: _____
Period: _____

NRHS Honors Biology Student Diet & Exercise Survey

INTRODUCTION: The purpose of this survey is to gauge how much Honors Biology students at North Royalton High School feel that diet and exercise effect their test scores. Respondents will be asked various questions about aspects of their normal diet and exercise, as well as their opinion on how each affects them in the normal classroom setting. Feedback will be used to students at North Royalton High School information about factors than can affect classroom performance. All responses will be held completely confidential, and will in no way be used to evaluate students. Your individual responses are anonymous, and will only be used in a collective fashion along with responses from others. You are being asked to respond to this survey to assist with the continued improvement of student learning North Royalton High School. As a new student at North Royalton High School, your responses an opinion is vital, so thank you in advance for your participation.

DIRECTIONS: Please check the appropriate response or supply the information requested for each section. If an item on this survey does not apply to you or you do not feel comfortable supplying that information, please leave that part blank. This survey should take no longer than 10-15 minutes to complete. When you have completed the survey, please place it in the collection bin at the front of the room.

PART I: DIET

How often do you eat the following meals?

	Never	Sometimes	Usually	Almost always	Always
Breakfast	( )	( )	( )	( )	( )
Lunch	( )	( )	( )	( )	( )
Dinner	( )	( )	( )	( )	( )

1. If I am having lunch away from home, I often choose a low-fat option.
   ( ) True ( ) False ( ) I never have lunch away from home
2. I usually avoid eating fried foods. ( ) True ( ) False
3. I usually eat a dessert if there is one available. ( ) True ( ) False
4. I make sure I eat at least one serving of fruit a day. ( ) True ( ) False
5. I try to keep my overall fat intake down. ( ) True ( ) False
6. If I am buying chips or another snack, I often choose a low-fat brand.
   ( ) True ( ) False ( ) I never buy snacks
7. I avoid eating lots of sausages and burgers.
   ( ) True ( ) False ( ) I never eat sausages or burgers
8. I often buy cookies or cakes. ( ) True ( ) False
9. I try to keep my overall sugar intake down. ( ) True ( ) False

10. I make sure I eat at least one serving of vegetables or salad a day.
    ( ) True ( ) False
11. If I am having a dessert at home, I try to have something low in fat.
    ( ) True ( ) False ( ) I don't eat desserts
12. I rarely eat takeout meals. ( ) True ( ) False
13. I try to ensure I eat plenty of fruit and vegetables. ( ) True ( ) False
14. I often eat sweet snacks or candy between meals. ( ) True ( ) False
15. I usually eat at least one serving of vegetables (excluding potatoes) or salad with my evening meal. ( ) True ( ) False
16. When I am buying a soft drink, I usually choose a diet drink.
    ( ) True ( ) False ( ) I never buy soft drinks
17. When I put butter or margarine on bread, I usually spread it thinly.
    ( ) True ( ) False ( ) I never have butter or margarine on bread
18. If I have a packed lunch, I usually include some chocolate and/or sweet snack. ( ) True ( ) False ( ) I never have a packed lunch
19. When I have a snack between meals, I often choose fruit.
    ( ) True ( ) False ( ) I never eat snacks between meals
20. If I am having a dessert in a restaurant, I usually choose the healthiest one.
    ( ) True ( ) False ( ) I never have desserts in restaurants
21. I eat at least three servings of fruit most days. ( ) True ( ) False
22. I generally try to have a healthy diet. ( ) True ( ) False

PART II: EXERCISE

How often do you do the following exercises in a typical week?

	Never	**Sometimes**	**Usually**	**Almost always**	**Always**
Flexibility	( )	( )	( )	( )	( )
Aerobic	( )	( )	( )	( )	( )
Anaerobic	( )	( )	( )	( )	( )

How many hours a week on average would you say you exercise, and what types of activities do you engage in?

Do you participate an any sports activities? ( ) Yes ( ) No
Please explain:

PART III: DEMOGRAPHICS

Be sure to check all that apply.

Gender: ( ) Male
( ) Female

Age: _____

GPA: _____

Appendix B

Exercise Log

	Type of Exercise	Amount of Time
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

Appendix C

Name: _____
Period: _____

NRHS Honors Biology Student Diet & Exercise Post Assessment Survey

INTRODUCTION: The purpose of this survey is to gauge how accurately the diet and exercise logs kept by Honors Biology students at North Royalton High School reflects their normal dietary and exercise habits. Respondents will be asked various questions about their normal dietary and exercise habits as compared to their individual logs. Feedback will be used to determine whether or not their log is a good representation of that student's nutrition and exercise. Respondents will also be asked their opinion as to whether or not either factor effects their learning in the regular classroom setting. All responses will be held completely confidential, and will in no way be used to evaluate students. Individual responses are anonymous, and will only be used in a collective fashion along with responses from others. Respondents are being asked to assist in this survey to continue improvement of learning. Thank you.

DIRECTIONS: Please check the appropriate responses or supply the information requested for each section. If an item on this survey does not apply to you or you do not feel comfortable supplying that information, please leave that part blank. This survey should take no longer than 10-15 minutes to complete. When you have completed the survey, please place it in the collection bin at the front of the room.

PART 1: DIET & EXERCISE LOG

How well do you feel that the nutrition survey you completed accurately describes your normal dietary patterns?

Very Accurately	Pretty Accurately	Somewhat Accurately	Not Very Accurately	Not Accurately at All
( )	( )	( )	( )	( )

How well do you feel that the exercise log you completed accurately describes your normal exercise regimen?

Very Accurately	Pretty Accurately	Somewhat Accurately	Not Very Accurately	Not Accurately at All
( )	( )	( )	( )	( )

In your opinion, do you feel that your diet affects your learning in the classroom?
( ) Yes ( ) No
Explain:

In your opinion, do you feel that the amount or type of exercise you regularly do affects your learning in the classroom? ( ) Yes ( ) No
Explain: