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Association between school performance and body mass index

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Abstract

The purpose of this paper is to determine the relationship between grade point average and other factors, including: body mass index, exercise habits, and weight perception. Data from School-Based Health Promotion Centers (SBHC) were used for this study. Students in sixth, seventh, and eighth grades were screened at the SBHC for a variety of behaviors and lifestyle characteristics using the Perkins Adolescent Risk Screen (PARS). Data from a total 579 students (281 males and 298 females; 278 sixth graders, 151 seventh graders, and 150 eighth graders) were obtained. Of these students, 145 were underweight, with a BMI less than 18.5; 241 were normal weight, with a BMI between 18.5 and 24.9; 100 were overweight, with a BMI between 25 and 29.9; and 93 were obese, with a BMI over 30. GPA and BMI were related ($r = -0.446$, $p < 0.01$). To see if BMI and GPA differed depending on weight perception and exercise, t-tests were conducted. T-tests were also conducted to see if GPA differed depending on BMI category. There were significant ($p < 0.05$) differences in GPA between the following groups: BMI under 25 vs BMI 25+, normal BMI vs abnormal BMI, exercise vs no exercise, and good weight perception compared to poor weight perception. These significant differences also existed when comparing males and females separately. There were also significant differences in BMI in exercise vs no exercise. Overall, a higher BMI related to a lower GPA. Lack of exercise and a poor weight perception were associated with a lower GPA.

Keywords: Adolescents, youth, obesity, exercise, body mass index, grade point average, weight perception

Introduction

Childhood obesity continues to increase in the United States and is a significant problem in Kentucky (1-3). It is especially prevalent in students of lower socioeconomic status and in those who engage in low levels of daily physical activity (4-6).

Child obesity has a significant effect on health-related quality of life (7). Obese children

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face orthopedic, endocrinal, gastroenterological, pulmonary, and neurological consequences, and these health problems increase their mortality rate (8). Being overweight during adolescence has important social and economic consequences. These individuals are less likely to get married, more likely to have a lower household income, and more likely have higher rates of household poverty (9). Also, they suffer more bullying and have a higher rate of self-esteem issues and depression than normal-weight teens (10-13).

In addition to the above factors, school performance is impacted. Overweight students demonstrate more detentions, worsened school attendance, more tardiness to school, and less participation on school athletic teams than their non-overweight peers (14). In addition, there's a negative effect on timely high school completion (15). Past studies in middle school through college aged students showed that more exercise is associated with a higher GPA and vice versa (16, 17).

More specifically, past studies show the relationship between an overweight or obese body mass index and poor grades. BMI is used in this study because the International Task Force on Obesity identified BMI as the most practical tool available to define obesity (18). Body mass is an important indicator of scholastic achievement, attendance, behavior, and physical fitness among students (14). Research demonstrates that being overweight or obese is associated with poorer levels of academic achievement (18-21). Specifically, overweight students demonstrate a lower GPA and lower national percentile reading scores than their non-overweight peers (14, 22).

Considering the above factors, it was hypothesized that a high BMI will be associated with a low GPA. The null hypothesis for this study was that there is no correlation between BMI and GPA. In addition, the present study evaluated the association between exercise status and GPA, exercise status and BMI, weight perception and GPA, and weight perception and BMI. For students with high BMIs, exercise and weight perception are important characteristics that may also be associated with GPA.

Implications for a relationship between the aforementioned variables include school-based interventions. Studies demonstrate that school-based interventions can improve health and academic

performance among low-income schoolchildren (23, 24). In one study, participation in a school breakfast program enhanced daily nutrient intake, which was associated with significant improvements in student academic performance and psychosocial functioning (25). Increased participation in school sports or physical education would also be valuable because students who put in more hours of physical activity daily were found to have better grade point averages and also have a healthier BMI (26). Finally, increased parental involvement at school is associated with lower BMIs (27).

Methods

Data from School-Based Health Promotion Centers (SBHC) in one middle school in Central Kentucky were used for this study. The middle school serves a low-income population, as more than 50% of the student body qualifies for free and reduced lunch. Students in sixth, seventh, and eighth grades were screened at the SBHC for a variety of behaviors and lifestyle characteristics via the Perkins Adolescent Risk Screen (PARS). This screening included data on student exercise status, weight perception, and many other factors. Students were excluded if their parents did not give consent for the screening. Body Mass Index was calculated by dividing the student weight in kilograms by the height in square meters. Later, student grade point averages were obtained from the school and matched to the student's ID number. A Pearson product-moment correlation was conducted to determine the relationship between GPA and BMI. T-tests were used to determine if there were significant differences in GPA depending upon BMI category overall and for male and female students separately. T-tests were also used to determine if there was a significant difference in BMI and GPA depending on a student's level of risk for weight perception and exercise.

Results

Data were obtained from a total 579 students (278 sixth graders, 151 seventh graders, and 150 eighth graders). Of these students, 145 were underweight,

with a BM! less than 18.5; 241 were normal weight, with a BM! between 18.5 and 24.9; 100 were overweight, with a BM! between 25 and 29.9; and 93 were obese, with a BM! over 30. There were 281 males and 298 females. The median BM! was 22.2

and the mean 23.52. Sixty-three percent of the students exercised and 37% did not. Eighty-seven percent of the students had good weight perception and 13% did not.

Table 1. Average GPA depending on BMI category, exercise status, and weight perception

GPA Averages Compared in T-test	N	Mean +/- SD	t	p-value
BM! under 25	386	3.28 +/- 0.44	15.38	<0.0001
BM! 25 and over	193	2.58 +/- 0.63		
Normal BM!	241	3.28 +/- 0.44	8.27	<0.0001
Abnormal BM!	338	2.88 +/- 0.66		
Female BM! under 25	195	3.30 +/- 0.43	10.50	<0.0001
Female BM! 25+	103	2.65 +/- 0.65		
Female normal BM!	121	3.32 +/- 0.44	6.09	<0.0001
Female abnormal BM!	177	2.91 +/- 0.64		
Male BM! under 25	191	3.26 +/- 0.45	11.62	<0.0001
Male BM! 25+	90	2.51 +/- 0.60		
Male normal BM!	120	3.24 +/- 0.43	5.48	<0.0001
Male abnormal BM!	161	2.85 +/- 0.67		
Exercise	365	3.10 +/- 0.56	2.53	<0.05
No exercise	214	2.96 +/- 0.68		
Good weight perception	504	3.08 +/- 0.59	3.16	<0.01
Poor weight perception	75	2.84 +/- 0.67		

As GPA increased, BM! decreased. The relation between GPA and BM! was statistically significant ($r = -0.446$, $p < 0.01$). There were significant differences in GPA for all groups (see Table 1). In addition, those with a poor weight perception had **significantly higher BMI's than those with a good weight perception** ($t = -2.54$, $p < 0.05$).

Discussion

Since the p values are very small, the null hypothesis are rejected, showing that high BM!, not exercising, and poor weight perception are all associated with lower GPAs. This means that students who are overweight or obese tend to perform more poorly in school. In addition, students who have high BM! may exercise less and have poor weight perception. This could be why not exercising and poor weight perception are also associated with lower GPAs.

Conversely, poor weight perception may be associated with depression, which relates to poorer academic performance. Future studies could evaluate other factors that are associated with GPA or what other factors associated with obesity affect learning behavior. The results from this study are similar to results from previous studies, underscoring the association between high BM! and low GPA and the need for school-based intervention.

Study limitations

As with all retrospective studies, random assignment and even distribution across groups is not possible, threatening the validity of the data. In addition, given the retrospective nature of the data, it is not possible to infer cause and effect between independent and dependent variables. We are limited to drawing conclusions based on relationships amongst variables.

Conclusion

Overall, a higher BMI tends to be associated with a lower GPA. In addition, not exercising and poor weight perception also seem to be associated with lower academic performance.

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