

The Relationship between the Level of Physical Activity and the Academic Achievement in High School Students

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Received: February 12, 2023 Accepted: March 9, 2023 Published: March 19, 2023

doi:10.5296/jei.v9i1.20740 URL: <https://doi.org/10.5296/jei.v9i1.20740>

Abstract

The aim of our research is to investigate the relationship between physical activity level and academic achievement in high school students. 12 of 13 Anatolian High Schools in Balikesir Central Districts were included in our research. A total of 334 (Female n = 190, Male n = 144) students selected from the 9th, 10th, 11th and 12th grades from these schools by random sampling method participated in the study. While the International Physical Activity Evaluation Questionnaire was used to determine the physical activity levels of the students, the academic achievement scores of the students were obtained from the e-school system of the Ministry of National Education. Descriptive statistics of the data obtained from the research were used to determine correlations between variables, Manova and Anova to determine whether there was a difference between variables, Post-Hoc Tests and Independent Sample “t” tests were used to determine the source of the differences between the variables. The significance level ($p < 0.05$) was taken. There was a negative correlation ($p < 0.05$) between students’ academic achievement levels and physical activity levels. While there were significant differences in academic achievement according to gender and grade level,

significant differences were found in physical activity only in terms of gender ($p < 0.05$). As a result, it was determined that academic achievement was negatively affected by physical activity, female students and 12th grade students had better academic success, while male students were more active. Considering the health benefits of physical activity as well as the importance of academic success for students to settle in a university, these two concepts should be considered together, and new plans should be developed.

Keywords: Physical activity level, Academic achievement, High school students

1. Introduction

Physical inactivity is one of the major health problems in our modern society. A century ago, people had to do their daily work physically, but the development of technology led to a more settled lifestyle (Akıncı, 2014). This settlement style has caused people to be more sedentary. Therefore, the decrease in physical activity has brought along various health problems (Akıncı, 2014).

Physical activity is defined as any body movement that needs more energy than rest (Torbeyns et al., 2014). In order to overcome physical inactivity, it is recommended to perform moderate-intensity-intensity physical activity for 150 minutes per week (Hallal et al., 2014). It is known that lack of physical activity causes some diseases such as childhood obesity, type 2 diabetes mellitus, cardiovascular diseases, hypertension, hyperlipidemia, stroke, colon cancer and breast cancer (Martinez-Zamora et al., 2021). While regular physical activities improve musculoskeletal health and immune system, they reduce diabetes mellitus, upper respiratory tract infections, coronary heart disease, hypertension, colon cancer, stroke, vascular and metabolic disorders, and all-cause mortality (Martinez-Zamora et al., 2021; Rowe et al., 2004).

It is thought that physical activity is not constant over time, and that it develops positive behaviors that can both gain health benefits and continue throughout life at a young age (Rodriguez et al., 2020). Besides these, the psychosocial benefits are known as one of the most positive benefits of physical activity. In addition to protecting and improving basic health, poor mental health can be prevented by physical activities (Haverkamp et al., 2021). In this context, the most effective method to increase community well-being is to carry out activities that encourage physical activity in all age groups (Batez et al., 2021).

Despite the known benefits related to physical activity, the biggest public health problem of the 21st century is physical inactivity (Maresova, 2014; Trost et al., 2014). Despite the increase in the number of overweight and obese children in other countries (*e.g.*, USA), as in our country, many schools reduce their physical education programs in order to provide more academic lessons (Yetgin et al., 2022). Although these curriculum changes are to increase the academic success of the students, the studies in the literature do not support this idea. In a study conducted in this direction, a positive relationship is pointed out between the level of physical activity or sports and participation in academic achievement (Taşkın & Özdemir, 2018).

In this study, physical activity, which is known to be important for health, was examined at

the high school level. Accordingly, the relationship between academic achievement and physical activity, which is very important in planning the future, has been discussed with the literature in this direction. At the same time, it is thought that this study will be a source for the literature in the context of the relationship between physical activity and academic achievement.

Accordingly, in this study, the relationship between the physical activity levels of high school students and their academic achievement was examined and the differences in terms of gender and academic achievement levels between classes were determined.

2. Method

2.1 Model of the Research

While the descriptive model questioning the existing situation was used in the research, the scanning method was preferred in order to describe and associate a past or present situation as it exists (Karasar, 2009).

2.2 Participants and Sampling Procedures

This research includes male and female students studying at Anatolian High Schools (n = 13) in Balıkesir Central districts in the 2017-2018 academic year. Using the random sampling method in the selection of the sample, three classes from each of the 4 levels (9th, 10th, 11th, and 12th grades) were randomly selected from each of the schools.

The population of this study consisted of 6700 students, and the sample consisted of 334 (Female n = 190, Male n = 144) students. Since the sample group constitutes 5% of the population, it is thought that it adequately represents all Anatolian high schools in Balıkesir Central districts, and the findings are generalizable to the population.

2.3 Data Collection

For the research, first of all, the approval of the Governor's Office, dated 12.04.2018 and numbered 99191664-605.01-E.7507277, was obtained from the Ministry of National Education, Balıkesir Provincial Directorate of National Education. The students' parents and themselves were informed about the research and a parent consent form was obtained from the parents.

While the "International Physical Activity Assessment Questionnaire" (IPAQ-International Physical Activity Questionnaire) was used to determine the physical activity levels of the students, the academic achievement scores of the students were obtained from the e-school system of the Ministry of National Education. The questionnaire form was personally applied to the students by the researcher between April-May 2018.

2.4 Data Collection Tools

International Physical Activity Questionnaire-IPAQ: The questionnaire is used to evaluate the level of physical activity (Hallal et al., 2014). Low physical activity level was accepted as less than 600 MET, moderate physical activity level between 601 and 3000 MET, and

vigorous physical activity level more than 3001.

Physical activity evaluation questionnaire FADA prepared by the researcher consists of 6 parts:

- (1) Descriptive Information (Age, height, body weight, etc.)
- (2) Work-related activities
- (3) Transportation related activities
- (4) Climbing stairs
- (5) Home related activities

MET/week (Kcal/kg/week), Kcal/week, MET/hours values of individuals are calculated using the physical activity evaluation questionnaire. It was used to calculate the obtained data (frequency × time × intensity).

Frequency: Indicates how many days per week the activity is performed.

Time: Indicates how long (hours or minutes) the activity is performed each time.

Intensity: It is the MET value of the activity spent per hour (Ainsworth et al., 2011).

$$\text{MET/Week (Kcal/Kg/Week)} = (\text{Frequency of Activity} \times \text{Total Time of Activity} \times \text{Intensity of Activity}) \quad (1)$$

$$\begin{aligned} \text{Kcal/Week} = & (\text{Frequency of Activity} \times \text{Total Time of Activity} \times \text{Intensity of Activity} \times \text{Body Weight}) \\ & \text{or (Kcal/Kg/Week)} \times \text{Body Weight} \end{aligned} \quad (2)$$

$$\text{MET/Hours} = (\text{Kcal/Kg/Week} \div \text{Hours/Week}^*) \quad (3)$$

Where, * hours spent per week in calculated index (Frequency of Activity × Time of Activity).

Example: Job Index:

Calculation of MET/Week or Kcal/Week:

$$\begin{aligned} \text{Work index} = & [(\text{How Many Days per Week}) \times (\text{How Many Hours per Day}) \times 1.5\text{MET}] \\ & + [(\text{How Many Days per Week}) \times (\text{How Many Hours per Day-Sitting Time}) \times 2.5 \text{ MET}] \\ = & [(5 \times 8 \times 1.5 \text{ MET}) + (5 \times (8 - 5) \times 2.5 \text{ MET})] = 97.5 \text{ MET/Week or Kcal/Kg/Week} \end{aligned} \quad (4)$$

$$\begin{aligned} \text{MET/Week (Kcal/Kg/Week)} = & [(\text{How Many Times in 1 Day} \times 0.5 \times 8 \text{ MET})] \times 7 \text{ Days} \\ = & [(5 \text{ Times} \times 0.5 \times 8 \text{ MET} \div 60) \times 7] \\ = & 2.3 \text{ MET/Week Kcal/Week} \\ = & (\text{Kcal/Kg/Week}) \div \text{Body Weight} \\ = & 2.3 \times 60 \text{ Kg} = 138 \text{ Kcal/Week} \end{aligned} \quad (5)$$

2.5 Analysis of Data

Statistical Packages for Social Sciences was used to analyze the data. In the analysis of data; Descriptive statistics (SD, percentage, frequency), Correlation test to detect relationships, Manova and Anova to determine whether there is a difference between variables, post-hoc tests to determine the source of differences and independent t-tests were used to tabulate the values. The level of significance was taken as ($p < 0.05$) for all tests.

3. Results

A total of 334 students, 190 (56.9%) female students and 144 (43.1%) male students, participated in this research. 83 participants (24.9%) were in the 9th grade, 95 (28.4%) were in the 10th grade, 67 (20.1%) were in the 11th grade, and 89 (26.6%) were in the 12th grade.

3.1 Classes' IPAQ and Academic Achievement Level

Table 1. Class-based descriptive analysis ($X \pm SD$) of the participants

Variable	9th grade		10th grade		11th grade		12th grade	
	(n)	$X \pm SD$	(n)	$X \pm SD$	(n)	$X \pm SD$	(n)	$X \pm SD$
Height (cm)	82	166.18±8.31	95	169.70±8.11	66	172.60±9.46	89	170.38±9.82
Age (years)	83	15.04±0.48	95	15.76±0.49	66	17.16±0.62	89	17.70±0.57
Body Weight (kg)	82	59.16±13.78	94	62.03±12.49	65	62.86±12.35	89	62.37±12.48
Academic Achievement Level	79	81.67±9.77	92	80.32±13.61*	67	84.39±10.92	88	85.75±13.05*
Physical Activity Levels (MET)	83	117.21±73.21	95	99.01±50.62	67	104.71±73.18	89	110.00±67.91
Body Mass Index (kg/m ²)	81	21.36±3.84	94	21.45±3.83	65	20.98±3.22	89	21.38±3.24

Note. * $p < 0.05$.

MANOVA results on academic achievement level and physical activity level in terms of class level revealed that there was a significant difference in terms of class variable ($WilksL(\lambda) = 0.960$; $F(6, 642) = 2.45$; $p < 0.05$).

When we examined the mean and standard deviation values of the scale for academic achievement and physical activity factors, one-way ANOVA values, a statistically significant difference was found between students' grade level and academic achievement level ($F(3, 322) = 3.651$; $p < 0.05$), According to the results of the Pos-Hoc test that we conducted to determine which class or classes caused the difference between classes, it was determined

that the academic achievement levels of the 12th graders were higher than that of the 10th grades, No significant difference was found in physical activity levels ($F(3, 322) = 0.965$; $p > 0.05$).

Table 2. Gender-based descriptive analysis ($X \pm SD$) of the participants

Variable	n	Female	n	Male	n	Total
		$X \pm SD$		$X \pm SD$		$X \pm SD$
Height (cm)	189	163.99 \pm 5.77	143	177.00 \pm 7.34	332	169.59 \pm 9.15
Age (years)	189	16.33 \pm 1.22	144	16.44 \pm 1.17	333	16.38 \pm 1.20
Body Weight (kg)	187	56.35 \pm 10.03	143	68.40 \pm 12.89	330	61.57 \pm 12.82
Academic Achievement Level	182	85.09 \pm 9.52*	144	80.25 \pm 14.57*	326	82.95 \pm 12.23
Physical Activity Levels (MET)	190	95.35 \pm 48.07*	144	123.77 \pm 81.62*	334	107.61 \pm 66.11
Body Mass Index (kg/m ²)	187	20.96 \pm 3.54	142	21.80 \pm 3.53	329	21.32 \pm 3.56

Note. * $p < 0.05$.

MANOVA results on academic achievement level and physical activity level in terms of gender revealed a significant difference in terms of gender variable (WilksL (λ) = 0.930; $F(2, 323) = 12.75$; $p < 0.05$).

A statistically significant difference was found between the genders of the students, their academic achievement levels ($F = 13.071$; $p < 0.01$) and physical activity levels ($F = 15.882$; $p < 0.01$). While the academic achievement level of female students was higher than that of males, the physical activity level (MET) of males was found to be higher than female students.

While the academic achievement level of female students ($t_{324} = 3.62$; $p < 0.01$) was found to be higher than that of males, the physical activity level (MET) of males ($t_{332} = -3.98$; $p < 0.01$) was found to be higher than female students.

Table 3. The relationship between the academic achievement and physical activity levels of the participants

Group	Variable		Physical Activity Levels (MET)
All Students	Academic Achievement Level	r	-0.17*
		p	0.00
		n	326.00
Female	Academic Achievement Level	r	-0.08
		p	0.31
		n	182
Male	Academic Achievement Level	r	-0.16
		p	0.06
		n	144

Note. * $p < 0.05$.

A negative relationship was found between the academic achievement status of all of the subjects participating in the study and the physical activity level (MET) ($r = -0.17$). There was no relationship between the academic achievement levels and physical activity levels of female and male students.

4. Discussion

Some studies in the literature indicate that increasing the level of physical activity does not decrease academic achievement (Arday et al., 2014; Matejek & Planinšec, 2022). There are many factors affecting academic success (Redondo-Flórez et al., 2022). For example, it is widely known that study time has the strongest effect on academic achievement, but it should not be forgotten that students are people, not machines. There is also a threshold level for studying. When the threshold level is reached, extra study time does not contribute to academic success (Coe et al., 2012). In Coe's study, students were divided into two groups, with one group given an extra hour of physical education, and the other group given an extra hour of academic instruction per day. The results proved that the physical education class did not show a decline academically compared to the academic education class. It can be said, then, that there must be a balance in the lives of students. Some scientists have claimed that academic achievement, boredom, concentration, and arousal that increase attention can be improved by increased physical activity (Coe et al., 2012; Donnelly & Lambourne, 2011; Käll et al., 2014; Lodewyk, 2009). Also, Arday et al. (2014) suggest in their study that increasing the amount of time devoted to physical education in the school curriculum may increase mental and physical health benefits in young people.

Although the importance of physical activity has emerged in many studies, the situation in

our research has unfortunately determined the opposite situation. In other words, a negative relationship was found between academic achievement and physical activity levels. As expected, the time spent studying increases academic achievement and decreases the level of physical activity. This may be due to the fact that students and parents suggest their children to study continuously instead of physical activity due to their concerns about the future, as well as the limitation of physical activity areas. As a result, the development due to the use of the time allocated for physical activity for academic success works unidirectionally and brings along psychological and physiological health problems.

According to the situation that emerged in this study, a significant difference was found between the 12th and 10th grades in terms of academic achievement levels. It is thought that the academic achievement levels of 12th graders are higher due to their preparation for the university exam. In addition, no difference was found between physical activity levels according to classes. However, when the physical activity averages are examined, it is understood that the highest average belongs to the 9th grades. In studies examining the relationship between the academic success of students studying in different classes and their anxiety levels in the literature, it has been observed that senior students have higher levels of anxiety because they are preparing for the university exam, and therefore they study more. For this reason, it is stated that they are more prepared and make an effort than the students in the lower class (Çapulcuoğlu & Gündüz, 2013; Kulaksızoğlu, 2007; Holly & Bilge, 2012; Rodriguez, 2020).

In this study, while it was observed that the academic achievement levels of women were higher than men, it was understood that the physical activity levels of men were higher than women. As there may be many reasons for this situation, it is thought that it is due to the fact that men generally go out and spend their time outside the home, and women spend their free time more at home and cannot find the opportunity for physical activity. In addition, it can be said that women can study more than men because they spend more time at home. Similar to this study, Bahar et al. (2009) examined the academic achievement scores of students in terms of gender and stated that there was a significant difference in favor of female students. In other studies, similar results were obtained and it was stated that gender had an effect on academic achievement (Bahar, 2006; Hermassi et al., 2021).

Considering the studies examining physical activity levels in terms of gender in the literature, Kargün et al. (2016) stated that the physical activity levels of male students were significantly higher than female students. It has been understood that studies conducted in this direction in the literature (Acree et al., 2006; Fisne, 2009; Shibata et al., 2007; Zhai et al., 2022) have obtained results similar to the results obtained in this study. In this sense, it can be said that the literature supports the results of this research.

5. Limitations and Recommendations

As a result of this research, while there was a negative relationship between academic achievement levels and physical activity levels, it was determined that the gender of the participants was effective on both academic achievement and physical activity level, while the grade level of the students was effective only on the academic achievement level. It has

been determined that female students and 12th grade students have better academic success, while male students are more active and active.

Contrary to this study, while most studies show that individuals with high physical activity levels have high academic achievement, in our study, there was a negative relationship. It is thought that this may be due to the higher academic achievement of 12th grade students. Because, 12th grade students focus only on their lessons due to their university exam anxiety and worries, causing them not to allocate time for physical activity. In addition, students cannot find enough space for physical activity both in the education system and in social life. Considering the health benefits of physical activity as well as the importance of academic success for students to settle in a university, these two concepts should be considered together and new plans should be developed.

In this context:

- Parents, students and teachers should be informed about the benefits of a physically active lifestyle and the harmful effects of a physically inactive lifestyle.
- In cities, the environment for physical activities should be arranged so that students have easy access to sports facilities. In addition, the environment of schools should be designed as places where healthy sports can be done.

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