

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY, BMI, AND STRESS IN 16-YEAR-OLD TEENS

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(Original scientific paper)

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Abstract

This study explored how regularly engaging in sports influences the physical and psychological growth of middle adolescents. It also compared these adolescents to those who do not take part in any sports activities. The study’s purposive sample included two groups; one group of 50 sixteen-year-old adolescents who regularly participated in sports; the other group of 50 sixteen-year-old adolescents who did not engage in any sports activities. In total, 100 mid adolescent students from Albania’s capital, Tirana, took part in the research. Standardized methods were used to assess anthropometric indicators (height, weight, BMI) as well as perceived stress levels using the PSS-10 scale. Descriptive and inferential statistics were applied, including correlation analysis and independent samples t-tests. Analysis of the data showed that the two adolescent groups differed significantly. Athletes presented significantly lower body weight ($M = 61.840 \pm 6.140$ kg) compared to non-athletes ($M = 78.780 \pm 5.830$ kg), with a t-value of -14.140 ($p < 0.001$). Similarly, athletes displayed a lower BMI ($M = 20.990 \pm 1.960$) than non-athletes ($M = 26.230 \pm 1.62$), reflected by a strong statistical difference ($t = -14.550$, $p < 0.001$). Perceived stress also differed substantially: athletes scored an average of 9.202 ± 3.620 , whereas non-athletes scored 20.260 ± 4.770 ($t = -13.030$, $p < 0.001$), indicating markedly higher stress levels among inactive students. Height was the only variable without a significant difference ($p = 0.0830$). Correlation analysis revealed strong positive associations between weight and BMI ($r = .730$), BMI and stress ($r = .5470$), and weight and stress ($r = .7120$), suggesting that higher body mass is linked to increased psychological stress. The results indicate that engaging in regular sports is associated with improved body composition and notably reduced stress levels among.

Key words: Physical activity, adolescents, BMI, stress, health.

Introduction

The mental health of adolescents has received more attention worldwide recently, due to the increasing prevalence of anxiety, depression, stress, low self-esteem, and behavioral challenges (Laurier, Pascuzzo, Jubinville, & Lemieux, 2024). A range of factors contribute to these challenges, including academic stress, family difficulties, feelings of social uncertainty, overuse of technology, and constant interaction with social networks. These factors raise the risk of anxiety, sleep problems, and low self-esteem, and they impact teens’ relationships and peer comparison (Morillo-Sarto et al., 2025). This developmental period is marked by substantial physical, cognitive, emotional, and social growth that contributes directly to later adult functioning (Dahl et al., 2018). During this stage, young people shape their personal identity, build autonomy and values, and form habits that will impact their future lives (Merino, Berbegal, Arraiz, & Sabirón, 2021). This stage also heightens the risk of mental health issues, as adolescents face pressures that can negatively affect their well-being (Gulliver et al., 2010).

Beyond academics, schools help shape teenagers’ social and emotional growth, making them a central part of adolescent development. They are good places for early identification of psychological problems and for implementing preventive programs (Fazel, Hoagwood, Stephan, Ford, 2014). Still, students’ well-being is commonly secondary to achieving high grades and academic results. Some ways to improve this include incorporating structured physical activity programs into the school day, offering more opportunities for extracurricular sports, and collaborating with local clubs and sports organizations to encourage sustained

participation. The lack of teamwork between school staff and health workers limits the ability to run full student health programs (Biddle & Asare, 2011). Physical activity refers to any body movement that makes you use more energy than you do at rest. In this sense, PA is not limited to recreational activities but includes all movements that contribute to an individual's physical health and well-being. Being active on a regular basis plays a key role in promoting the overall health of young people (Caspersen, Powell, & Christenson, 1985; WHO, 2024).

Worldwide, a large majority (81%) of adolescents aged 11–17 fail to meet recommended activity levels, with clear differences across genders, regions, and countries (Lee et al., 2012). Physical activity is associated with a lower number of depressive symptoms [Gerber, Brand, Herrmann, Colledge, Holsboer-Trachsler, Pühse, 2014), which is the most common mental health problem in the United Kingdom. It has also been observed that physical activity can predict body mass index (BMI) levels (Parikh, Stratton, 2011). Maintaining a high level of physical activity can improve both physical and mental well-being, enhancing fitness, lowering depressive symptoms, and decreasing body fat. Being very active can improve quality of life in several ways. It helps people stay fit, reduces feelings of depression, and lowers body fat

Methods

Participants

High school students aged 16 were included in the study after their parents gave voluntary consent. Initially, a total of 266 students from the capital of Albania, Tirana, were included in the research. However, for the purposes of this paper, 50 students who had participated in sports activities for at least one year and 50 students who had not participated in sports activities and had a body mass index above the normal range (24.9) were selected. This division was made to compare differences between physically active and inactive adolescents with respect to the studied variables, allowing for a clearer and more structured analysis of the results.

Measurements

In this study, anthropometric and psychological variables were used, which have been applied in numerous previous studies and have demonstrated stable metric properties, thus justifying their use for the purposes of this research. Participants' height and weight were measured so we could calculate their BMI, according to WHO recommendations (2000). The 10-item PSS-10 (Cohen, Kamarck, and Mermelstein, 1983) was employed to evaluate everyday stress in adolescents and has been validated for their age. Both indicators—BMI and PSS-10 are widely used in research to examine overweight, the relationships between physical activity and eating habits, as well as their impact on adolescents' health and psychological well-being. The use of these instruments allows for an integrated assessment of the physical and psychological factors influencing adolescents' quality of life.

Statistical analysis

Analysis Descriptive measures, including mean, standard deviation, minimum and maximum values, skewness, kurtosis, and the coefficient of variation, were determined for physically active and inactive adolescent groups. Independent samples t-tests were used to compare variables with normal distributions between groups. A threshold of $p < 0.05$ was considered statistically significant.

Results

Results are expressed as mean \pm standard deviation for each group, along with the respective p-values. An overview of the descriptive values for the student athletes is shown in Table 1, including N, range, mean, SD, skewness, kurtosis, and Kv, which represents the variability relative to the mean."

Table 1. Summary of descriptive statistics for student-athlete participants

	N	Minimum	Maximum	Mean	Std. Dev	Skewness	Kurtosis	Kv
HEIGHT	50	156.70	179.00	171.68	4.86	-.803	.795	2.83
WEIGHT	50	49.40	73.80	61.84	6.14	.306	-.199	9.93
BMI	50	18.20	27.10	20.99	1.96	1.074	.833	9.36
PSS10	50	5.00	17.00	9.22	3.62	.575	-.909	39.28

The research sample consisted of 50 individuals, for whom height (HEIGHT), weight (WEIGHT), Body Mass Index (BMI), and stress levels measured by the PSS10 scale were recorded. The participants' heights ranged from 156.7 cm to 179 cm, averaging 171.68 cm with a standard deviation of 4.86, showing that most measurements were close to the mean. Slight left skew (skewness = -0.803) and moderate kurtosis (0.795) were observed. The participants' weights ranged from 49.4–73.8 kg, mean 61.84 kg, SD 6.14, reflecting moderate dispersion. The values are somewhat left-skewed and moderately centered on the average. Participants' BMI ranged from 18.2 to 27.1 (mean = 20.99, SD = 1.96), showing a right-skewed distribution (skewness = 1.074) with mild concentration around the mean (kurtosis = 0.833). Stress (PSS-10) 5–17, mean 9.22, SD 3.62; right-skewed (0.575), flat distribution (-0.909), high variability. While the participants are largely similar in terms of physical characteristics, their stress levels differ widely. The group is physically uniform, yet variation in perceived stress may impact performance and psychological health.

Measurements of the group of non-athlete students

Descriptive statistics for height, weight, BMI, and PSS-10 scores in non-athlete students are displayed in the table, showing sample size, range, mean, SD, skewness, kurtosis, and variation coefficient. This provides an overview of the participants' physical characteristics and stress (Table 2).

Table 2. Key descriptive statistics for the non-athlete student cohort

	N	Minimum	Maximum	Mean	Std. Dev	Skewness	Kurtosis	Kv
HEIGHT	50	161.40	180.20	173.3	4.39	-.626	-.001	2.53
WEIGHT	50	68.00	95.00	78.78	5.83	.979	1.679	7.41
BMI	50	24.50	33.60	26.23	1.62	2.860	9.697	6.17
PSS10	50	11.00	29.00	20.26	4.77	-.217	-.706	23.55

Descriptive measures for a sample of 50 non-athlete students are shown in Table 2, covering height, weight, body mass index, and perceived stress, indicating uniformity in physical traits. The study measured several factors, such as participants' height, weight, body mass index, and perceived stress (PSS-10). The results indicate that the group is relatively homogeneous in terms of physical characteristics. The mean height was 173.3 cm (SD = 4.39), indicating that students' heights are fairly consistent. With weights averaging 78.78 kg and SD of 5.83 kg, the distribution shows more spread than that of height. The group's mean BMI is 26.23, indicating that most students fall near the upper end of the overweight category, with a few individuals exceeding this range. The BMI data are highly skewed (2.860) and display elevated kurtosis (9.697), suggesting that a number of students have BMI values beyond the typical range. Perceived stress (PSS10) has an average of 20.26 and a standard deviation of 4.77, reflecting greater variability among students compared to the physical characteristics. The stress distribution is relatively normal, with a slight tendency toward lower values (skewness -0.217; kurtosis -0.706). A coefficient of variation of 23.55% indicates substantial differences in perceived stress among the participants. Overall, the group of non-athlete students is physically stable and homogeneous in height and weight; however, some individuals have BMI above the normal range. The greatest variability is observed in perceived stress, indicating that while physical traits are fairly uniform, psychological experiences differ considerably among individuals. This degree of variation may affect the students' general health and performance outcomes.

Intercorrelation matrix

Table 3 presents Pearson correlations between height, weight, BMI, and perceived stress, along with 2-tailed significance values and sample size (N). The table summarizes the associations between students' physical traits and their perceived stress levels. Presented here are the correlations among the measured variables, including height, weight, BMI, and perceived stress (PSS10), for the student group. This table displays the correlations among the measured variables in the student group, including height, weight, BMI, and perceived stress (PSS10). Pearson correlation values and two-tailed p-values, calculated from 50 participants, provide insight into the relationships between these variables, showing some interesting patterns.

As we would expect, weight goes hand in hand with BMI (.730), which is understandable given how "BMI" is calculated. The findings suggest that students' stature correlates with weight (.593**) and shows a milder correlation with stress (.405**), pointing to potential differences in stress perception by height. A

correlation of .547** suggests that students with greater BMI values generally report higher levels of perceived stress. With weight exhibiting a strong correlation (.712**) and height and BMI showing moderate ones, the findings imply that aspects of physical build may partially shape students' stress responses. Overall, the analysis suggests an interdependence between physical characteristics and perceived stress. Weight and BMI seem to affect stress the most, while height has a smaller impact. These results suggest that physical characteristics might be connected to mental well-being, which could affect students' health.

Table 3. Intercorrelations among measured variables

		HEIGHT	WEIGHT	BMI	PSS10
HEIGHT	Pearson Correlation	1	.593**	-.116	.405**
	Sig. (2-tailed)		.000	.424	.004
	N	50	50	50	50
WEIGHT	Pearson Correlation	.593**	1	.730**	.712**
	Sig. (2-tailed)	.000		.000	.000
	N	50	50	50	50
BMI	Pearson Correlation	-.116	.730**	1	.547**
	Sig. (2-tailed)	.424	.000		.000
	N	50	50	50	50
PSS10	Pearson Correlation	.405**	.712**	.547**	1
	Sig. (2-tailed)	.004	.000	.000	
	N	50	50	50	50

Analysis of differences

The results of an independent samples t-test comparing athlete and non-athlete students across height, weight, BMI, and perceived stress (PSS10) are presented in Table 4. The table provides Levene's test for equality of variances, along with t-values, degrees of freedom, significance levels, mean differences, standard errors, and 95% confidence intervals. These results show whether the two groups differ significantly in their physical and psychological characteristics. From this table we can see that students who have been active in sports and those who have not are distinguished in all the variables applied, except for body height. The analysis using independent samples t-tests and Levene's Test for equality of variances shows that height does not differ significantly between the two groups, with athletes being on average 1.624 cm shorter than non-athletes ($t = -1.75$, $df = 98$, $p = 0.083$).

Table 4. Analysis of statistical differences between groups

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% Confidence Interval of the Difference	
								Lower		Upper
HEIGHT	Equal var. assumed	.567	.453	-1.75	98	.083	-1.624	.925	-3.46	.21
	Equal var. not assumed			-1.75	97.032	.083	-1.624	.925	-3.46	.21
WEIGHT	Equal var. assumed	.767	.383	-14.14	98	.000	-16.943	1.198	-19.32	-14.56
	Equal var. not assumed			-14.14	97.746	.000	-16.943	1.198	-19.32	-14.56
BMI	Equal var. assumed	4.873	.030	-14.55	98	.000	-5.240	.360	-5.95	-4.52
	Equal var. not assumed			-14.55	94.543	.000	-5.240	.360	-5.95	-4.52
PSS10	Equal var. assumed	2.684	.105	-13.03	98	.000	-11.040	.847	-12.72	-9.35
	Equal var. not assumed			-13.03	91.385	.000	-11.040	.847	-12.72	-9.35

In contrast, substantial differences are observed in weight, BMI, and perceived stress. Athletes have a significantly lower weight than non-athletes, with an average difference of 16.943 kg ($t = -14.14$, $df = 98$, $p < 0.001$), and their BMI is also lower by 5.240 units ($t = -14.55$, $df = 94.543$, $p < 0.001$). Those active in sports have lower stress levels, about 11 points less than non-active students. The confidence intervals for these differences provide additional evidence of their statistical and practical importance. Overall, athletes are about the same height as non-athletes, but playing sports is linked to being lighter,

having a lower BMI, and feeling less stressed, showing that regular exercise helps both the body and the mind.

Discussion

The present study examined the physical and psychological differences between adolescent students engaged in regular sports activities and those who were physically inactive with elevated BMI. Results indicate significant differences in weight, BMI, and perceived stress (PSS-10) between the two groups, while height remained similar. Students who exercise regularly have lower BMI and body weight than their non-athlete peers, showing the positive effect of staying active (Strong et al., 2005). The results show that regularly playing sports can help prevent overweight and obesity, which are linked to health problems like heart and metabolic diseases (WHO, 2021). Regular physical activity appears to reduce stress, as athletes showed significantly lower perceived stress levels. Regular physical activity and sports, at least three times a week, help reduce stress and improve mood (Salmon, 2001; Biddle & Asare, 2011).

The correlation analysis further indicated that BMI and weight were positively associated with perceived stress, implying that higher body mass may exacerbate stress perception among adolescents. Because body height is mostly influenced by genes, environmental factors like activity have little effect, making physical activity more important for body composition than for growth." Interestingly, the intercorrelations revealed that students with higher BMI tended to report higher stress levels, which is consistent with studies linking overweight status to increased psychological distress and lower self-esteem (Puder & Munsch, 2010). The findings show that regular sports participation and physical activity, along with recreational engagement, support adolescents' physical and mental health. Healthier BMI and lower stress among adolescents in sports contribute to stronger academic and social "performance". In contrast, physically inactive students with higher BMI are at greater risk of stress-related health issues, underscoring the need for targeted interventions to promote physical activity. The study's 'small sample size' and focus on one urban area may limit how widely the findings can be "generalized". Future research could examine longitudinal effects of physical activity on stress and BMI in larger and more diverse adolescent populations. Moreover, examining other psychological factors (such as 'self-esteem' or 'depression') could offer a more complete understanding of how physical activity affects mental health in adolescents. In conclusion, this study provides evidence that regular sports participation among adolescents is associated with healthier body composition and lower perceived stress. Promoting regular physical activity within educational and community contexts is important for supporting adolescents' physical and psychological health (Janssen & LeBlanc, 2010). Physical activity and sports during mid-adolescence can help not only to improve physical health but also to develop coping mechanisms and increase resilience to everyday stress.

Conclusion

The present study highlights the significant impact of regular sports participation on adolescents' physical and psychological well-being. Active students have lower weight and BMI than inactive students. Athletes experienced lower stress, suggesting that sports benefit adolescent mental health and coping skills. The positive correlations between BMI, weight, and stress indicate that higher body mass may contribute to increased psychological distress in inactive students. Beyond physical gains, sports reduce stress and enhance adolescents' mental toughness. Higher BMI and weight were linked to increased stress among inactive students, while height remained unaffected, indicating that physical activity shapes body composition rather than growth.

The findings underscore sports' combined impact on physical fitness and psychological health. Implementing programs that promote regular physical activity in educational and community settings can serve as an effective preventive measure against overweight, obesity, and stress, thereby improving adolescent health outcomes. Future studies should focus on larger and more diverse groups of people and also examine other psychological aspects, such as self-esteem, susceptibility to stress, and other cognitive traits. The findings indicate that sports affect middle adolescents' health in both physical and psychological ways. Implementing programs that promote regular physical activity in educational and community settings can serve as an effective preventive measure against overweight, obesity, and stress, thereby improving adolescent health outcomes. Future studies should focus on larger and more diverse groups of people and also examine other psychological aspects, such as self-esteem, susceptibility to stress, and other cognitive traits. The findings indicate that sports affect middle adolescents' health in both physical and psychological ways.

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