CHOICE OF PARTICULAR SPORTS ACTIVITIES AND ACADEMIC SUCCESS OF MIDDLE SCHOOL PUPILS

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Abstract

There is a view that playing sports is positively related to pupils' academic achievement. Results of studies worldwide indicate this correlation, while few studies have been done in Bosnia and Herzegovina on this problem. The current study aims to expand on findings from previous studies by examining associations between (1) mode: active vs. recreational); (2) type: individual vs. team based and (3) a particular kind of sports and academic achievement particularly math achievement among middle school children. Population involves middle school pupils in two urban areas in Bosnia and Herzegovina and research sample consists of 1036 female and 1055 male pupils wanting to take part in study voluntarily. Kruskal-Wallis and Wilcoxon test were conduced to obtain results. Results show that middle school pupils who are actively involved in sports have better overall midterm academic success as well as better mathematics achievement compared to those who are involved in sports recreationally or not at all ($p < 0.001$). On the other hand, differences do not occur between pupils who are engaged in team or individual sports. Also, pupils who practice football were found to have lower school performance compared to pupils who practice some of the other sports.

Key words*: sports activities, school success, middle school pupils*

Introduction

We can notice that there is perpetual interest of researchers in factors that influence academic achievement of pupils. Athletes are more motivated to achieve, and therefore have a very strong need to achieve success that applies not only to sport success but also to success in general. Athletes' intrinsic impulses motivate them in all aspects of life, including at school, to strive to achieve the best results and to achieve their set goals (Cox, 2005). Some research have confirmed the value and benefits of participation in general physical activity with respect to higher academic achievement and good school conduct. (Field at al, 2001; Lau at al, 2004, Grissom, 2005, Dyer at all, 2017). Findings of Grissom's study (2005) supported the presence of a positive relationship between physical fitness and academic achievement (/in reading and in mathematics) assessed by the Stanford Achievement Test 9* Edition and pointed that relationship was stronger for girls in comparison to boys. Stevens at al (2008) differentiate aerobic activity, exercise and sports team/league within physical activity and compare participation in those activities to math and reading achievement of fifth gradres. The results indicated that physical activity engagement of children was more positively influential on math and reading achievement. Esteban-Cornejo et al. (2014) found that activities promoting cardiorespiratory capacity and motor ability benefited students' academic performance, but activities promoting muscular strength were not significantly correlated with such performance.

The focus practiced in the sports activity may translate to better focus in learning. Varešlija i Palić (2012) stated that engaging in sports activities had a particularly positive effect on pupils' concentration. Therefore, regular training also affects pupils' classroom discipline and ability to manage their time. Pupils who know how to manage time are able to organize and distribute the learning content they need to master.

Sport can be played as a team or as an individual. It is possible that these different types of sport may contribute differently to focus in the field, and subsequently focus in learning, which reflects in better grades. Furthermore, it is possible that involvement in a particular kind of sports can be related to academic success.

We are unaware of any research that examined these relationships among pupils in Bosnia and Herzegovina. Thus, the current study was conducted to add to the limited research on the effect that participation in sports activities have on middle school students' math and general achievement in Bosnia and Herzegovina.

Methodology

The current study aims to expand on findings from previous studies by examining associations between (1) mode: active vs. recreational), (2) type: individual vs. team based and (3) a particular kind of sports and academic achievement particularly

math achievement among middle school children. Sex differences in associations were explored as a secondary aim.

School achievement in each of the school subjects and general school success in Bosnia and Herzegovina is declared through grades 1 to 5 that represent ranks of school success: grade 5 – excellent, grade 4 – very good, grade 3 – good, grade 2 – sufficient and grade 1 - insufficient. The school achievement is determined at midterm and at the end of school year and often the midterm grades give more objective insight into pupils achievement as some teachers tend to push pupils grades in higher rank at the end of school year. For that reason, in this study we were focused in pupils' school success at the midterm.

Participants

Population involves middle school pupils in two urban areas in Bosnia and Herzegovina and research sample consists of 1036 female and 1055 male pupils wanting to take part in study voluntarily, in total there are 2091 pupils. Furthermore, written consent from parents/ legal guardians were collected.

Data colection and instrument

Two procedures had been used in order to collect the data. Information about midterm general school success, mathematics achievement and physical and health education achievement is obtained upon evidence in school documentation, i.e. evidence list of school success at the midterm (end of december). Furthermore, the form was developed and used to collect data from pupils about participation in extracurricular and/or club activities, types of activities, motivation, frequency of participation (Pjanic at al, 2021).

Statistical Analyses

To reveal the characteristics of pupils and school success, frequency and percentage distributions were carried out. Kruskal-Wallis test followed by Dunn's pairwise tests adjusted using the Bonferroni correction was carried out to analyze the differences in midterm general school success and mathematics achievement according to mode, type and kind of sports activities. Wilcoxon signed-rank tests was conducted to determine if there is significant difference in midterm general school success and mathematics achievement in each category of pupils.

Results and disscussion

Research sample consists of 2091 middle school pupils, 1055 male and 1036 female, from two urban areas in Bosnia and Herzegovina. Table 1 and Table 2 show distribution of participants according to age/grades and participation in sports and mathemaics extracurricular and/or club activities.

Table 1. *Distribution of pupils according to age (grades)*

Age/grade	N	%
10-11 years : grade 5	111	5.3
11-12 years: grade 6	327	15.6
12-13 years: grade 7	320	15.3
13-14 years: grade 8	658	31.5
14-15 years: grade 9	675	32.3

Table 2. *Participation in extracurricular and/or club sport activities*

activity	N	%
none or non-sports	719	34.5
sport	1372	65.6

Number of participants in sport activities includes those pupils who declared that are involved in only sports activities or sports and other sorts of extracurricular activities (eg. mathematics clubs). Within pupuls who participate in sports activities we can observe those who are involved in sports activities actively, i.e. who participate in sports activities in a specific regime and participate in sports competitions, and those who participate in sports recreationally i.e. who are involved in sports from time to time. Table 3 shows numbers and percentages of pupils who participate in sports activities actively and recreationally, as well as those who are involved in team or individual sports.

Table 3. *Participation in extracurricular and/or club sport activities by mode and type*

activity			N	% within sport	% total
None / non-sport			719		34.4
sport	mode	active	747	54.4	35.7
		recreational	625	45.6	29.9
	type	team	927	67.6	44.3
		individual	445	32.4	21.3

Table 4. *Participation in extracurricular and/or club sport activities by gender*

Sport activity		female	male	N
mode	active	318	429	747
	recreational	301	324	625
	total	619	753	1372
type	team	362	565	927
	individual	257	188	445
	total	619	753	1372

Examining pupils' answers we counted 31 different kinds of sports (sport disciplines) in which pupils are involved. The most popular sport is football (soccer). We grouped all combat sports in one category - martial arts (combat sports). Similarly, we grouped athletics, gymnastics and dance disciplines. Finally, we grouped sports with frequencies less than 5 in one group – unpopular sports (kayak, skiing, ice-skating, water polo, horse-riding). This procedure resulted with 13 kinds of sports those pupils are engaged in (Table 5).

Table 5. *Participation in different kinds of sports*

Sport discipline	N	%
football	379	27.6
volleyball	238	17.3
martial arts	224	16.3
basketball	182	13.3
dance	95	6.9
athletics	66	4.8
cycling	51	3.7
handball	30	2.2
fitness	28	2.0
gymnastics	21	1.5
swimming	21	1.5
unpopular sports	19	1.4
tennis	18	1.3
total	1372	

Pjanić at al (2021) find that pupils who participate in sport extracurricular or club activities have better general midterm school success compared to pupils who do not participate in sports and math extracurricular activities ($p = 0.003$). In this study, general school midterm success was compared between three groups of pupils: pupils who do not participate in sports activities, pupils who are involved in sports actively and pupils who are involved in sports recreatioanlly.

A Kruskal-Wallis test provided very strong evidence of a difference ($\chi^2 = 35.679$, $df = 2$, $p = 0.000$) between the mean ranks of at least one pair of groups. Dunn's pairwise tests were carried out for the three pairs of groups (Table 6).

Table 6. *Comparison of pupils' general midterm school success according to participation in different mode of extracuricular sport activities*

	activity	N	Mean rank	Test stat.	z	p
General school success midterm	none or nonsport	719	975.70	-169.059	-5.657	**.000**
	active	474	1144.76			
	none or nonsport	719	975.70	-33.121	-1.059	.869
	recreational	625	1008.83			
	recreational	625	1008.83	135.938	4.384	**.000**
	active	474	1144.76			

There was very strong evidence ($p < 0.001$, adjusted using the Bonferroni correction) of a difference in general midterm school success between pupils who are involved in sports actively and pupils who are not involved in sports as well as between pupils who are involved in sports actively and those who are involved in sports recreationally. Pupils who are involved in sports actively have better midterm general school success than other pupils.

Same test procedure was conducted for male and female pupils. A Kruskal-Wallis test provided very strong evidence of a difference ($\chi^2 = 20.303$, $df = 2$, $p = 0.000$) between the mean ranks of at least one pair of groups of girls as well as of boys ($\chi^2 = 38.855$, $df = 2$, $p = 0.000$). Test results shows that there is no signifficatnt difference in general midterm success only between girls who are involved in sports recreationally and those who do not participate in sports activities. Other pairs differ signifficantely (Table 7). According to mean rank and test results, girls and boys who are involved in sports activities actively have signifficantly better midterm general school success than other categories of pupils.

Table 7. *Comparison of female and male pupils' general midterm school success according to participation in different mode of extracuricular sport activities*

		activity	Test stat.	z	p
General school success midterm	female	none/nonsport - active	-84.888	-4.122	**.000**
		none/nonsport – recreat.	-2.294	-0.110	1.000
		recreational - active	82.594	3.713	**.001**
	male	none/nonsport - active	-63.721	-5.657	**.019**
		none/nonsport – recreat.	-135.729	-1.059	**.000**
		recreational - active	72.007	4.384	**.002**

In the same manner, midterm mathematics achievement was compared between three groups of pupils: pupils who do not participate in sports activities, pupils who are involved in sports actively and pupils who are involved in sports recreatioanlly.

A Kruskal-Wallis test provided very strong evidence of a difference ($\chi^2 = 34.177$, df = 2, p = 0.000) between the mean ranks of at least one pair of groups. Dunn's pairwise tests were carried out for the three pairs of groups (Table 8). There was very strong evidence ($p < 0.001$, adjusted using the Bonferroni correction) of a difference in midterm mathematics achievement between pupils who are involved in sports actively and pupils who are not involved in sports as well as between pupils who are involved in sports actively and those who are involved in sports recreationally. Pupils who are involved in sports actively have better midterm mathematics achievement than other pupils.

Table 8. *Comparison of pupils' midterm mathematics achievement according to participation in different mode of extracuricular sport activities*

	activity	N	Mean rank	Test stat.	z	p
Midterm mathmatics achievement	none or nonsport	719	971.87	-172.035	-5.618	**.000**
	active	474	1143.91			
	none or nonsport	719	971.87	-42.577	-1.322	.558
	recreational	625	1014.25			
	recreational	625	1014.25	129.658	4.081	**.000**
	active	474	1143.91			

Same test procedure was conducted for male and female pupils. A Kruskal-Wallis test provided very strong evidence of a difference ($\chi^2 = 18.955$, df = 2, p = 0.000) between the mean ranks of at least one pair of groups of girls. Same result is obtained for boys ($\chi^2 = 29.707$, df = 2, p = 0.000). Test results shows that there is no significant difference in midterm mathematics achievement between girls who are involved in sports recreationally and those who do not participate in sports activities. Other pairs differ significantly (Table 9). According to mean rank and test results, girls and boys who are involved in sports activities actively have significantly better midterm mathematics achievement than other categories of pupils.

Table 9. *Comparison of female and male pupils' midterm mthematics achievement according to participation in different mode of extracuricular sport activities*

		activity	Test stat.	z	p
Midterm mathematics achievement	female	none/nonsport - active	-88.187	-4.082	**.000**
		none/nonsport – recreat.	-8.070	-0.368	.713
		recreational - active	80.117	3.433	**.001**
	male	none/nonsport - active	-56.718	-5.406	**.000**
		none/nonsport – recreat.	-119.822	-2.403	**.049**
		recreational - active	63.104	2.906	**.011**

Participation in sports activities can be observed in the lens of type of sports, i.e. if pupils participate in individual or team sports. General school midterm success was compared between three groups of pupils: pupils who do not participate in sports activities, pupils who are involved in team sports and pupils who are involved in individual sports.

A Kruskal-Wallis test provided very strong evidence of a difference (χ^2 = 21.681, df = 2, p = 0.000) between the mean ranks of at least one pair of groups. Dunn's pairwise tests were carried out for the three pairs of groups (Table 10).

Table 10. *Comparison of pupils' general midterm school success according to participation in different types of extracuricular sport activities*

	Activity type	N	Mean rank	Test stat.	z	p
General school success midterm	none or nonsport	719	975.70	-82.896	-2.916	**.011**
	team	927	1058.60			
	none or nonsport	719	975.70	-157.625	-4.568	**.000**
	individual	455	1133.33			
	team	927	1058.60	-74.728	-2.265	.070
	individual	455	1133.33			

There was strong evidence (p < 0.05, adjusted using the Bonferroni correction) of a difference in general midterm school success between pupils who are involved in both team and individual sports and pupils who are not involved in sports. Pupils who are involved in sports have better midterm general school success than other pupils. However, there is no significant difference in midterm general school success between pupils involved in team sports and those involved individual sports.

Same test procedure was conducted for male and female pupils. A Kruskal-Wallis test provided very strong evidence of a difference (χ^2 = 28.126, df = 2, p = 0.000) between the mean ranks of at least one pair of groups among boys. Also, there is strong evidence of difference between mean ranks of at least one pair of groups among girls (χ^2 = 7.055, df = 2, p = 0.029). Test results shows that in both subgroups there is no significatnt difference in general midterm success between girls (boys) who are involved in individual sports and those who are involved in team sports. Also, there is no significant difference in midterm school success between girls who are involved in team sports and those who do not participate in sports activities (Table 11).

Table 11. *Comparison of female and male pupils' general midterm school success according to participation in different types of extracuricular sport activities*

		activity	Test stat.	z	p
General school success midterm	Female	none/nonsport - team	-37.842	-1.905	.171
		none/nonsport – individual	-2.481	-2.481	**.039**
		team - individual	-0.735	-0.735	1.000
	Male	none/nonsport - team	-100.555	-4.905	**.000**
		none/nonsport – individual	-117.341	-4.320	**.000**
		team - individual	-16.787	'-0.682	1.000

Midterm mathematics achievement was compared between three groups of pupils: pupils who do not participate in sports activities, pupils who are involved in team sports and pupils who are involved in individual sports.

A Kruskal-Wallis test provided very strong evidence of a difference (χ^2 = 20.498, df = 2, p = 0.000) between the mean ranks of at least one pair of groups. Dunn's pairwise tests were carried out for the three pairs of groups (Table 12). There was very strong evidence (p < 0.005, adjusted using the Bonferroni correction) of a difference in midterm mathematics achievement between pupils who are involved in individual or team sports and pupils who are not involved in sports. However, there is no difference in midterm mathematics success between team sports and individual sports participants.

Table 12. *Comparison of pupils' midterm mathematics achievement according to participation in different types of extracuricular sport activities*

	activity	N	Mean rank	Test stat.	z	p
Midterm mathmatics achievement	none or nonsport	719	971.87	-94.066	-3.229	**.004**
	team	927	1065.94			
	none or nonsport	719	971.87	-152.351	-4.309	**.000**
	individual	455	1124.23			
	team	927	1065.94	-58.285	-1.724	.254
	individual	455	1124.23			

Same test procedure was conducted for male and female pupils. A Kruskal-Wallis test provided very strong evidence of a difference (χ^2 = 7.661, df = 2, p = 0.022) between the mean ranks of at least one pair of groups of girls. Similar result is obtained for boys (χ^2 = 21.566, df = 2, p = 0.000). Test results shows that there is no difference in midterm mathematics achievement between both girls and boys who are involved in individual sports and those who participate in team sports. Also, there is no significant difference in midterm mathematics achievement between girls who are involved in team sports and those girls who do not practice sports. Other pairs differ significantly (Table 13).

Table 13. *Comparison of female and male pupils' midterm mthematics achievement according to participation in different types of extracuricular sport activities*

		activity	Test stat.	z	p
Midterm mathematics achievement	female	none/nonsport - team	-42.342	-2.031	.127
		none/nonsport – individ.	-58.929	-2.561	**.031**
		team - individual	-16.587	-0.701	1.000
	male	none/nonsport - team	-89.261	-4.244	**.000**
		none/nonsport – individ.	-102.914	-3.755	**.001**
		team - individual	-13.653	-0.550	1.000

Taking into account that we identified 13 kinds of sports pupils are engaged in, midterm general school success and mathematics achievement was compared between 13 groups of pupils according to choice of sport. At first, distribution of midterm general school success is examined in 13 groups of sports. A Kruskal-Wallis test provided very strong evidence of a difference (χ^2 = 80.114, df = 12, p = 0.000) between the mean ranks of at least one pair of groups. The lowest mean rank have fitness (523.304) and football (570.119) and the highest mean rank has tennis (908.306) Pairwise comparison reveals significant differences in distribution of midterm general school success between football and basketball, dance, volleyball, gymnastics, tennis and combat sports (p<0.015). Same results appears for fitness and dance (p = 0.017) as well as fitness and gymanstics (p = 0.031) and tennis (p = 0,049).

The same procedure is repeated to determine if distribution of midterm mathematics achievement is the same in 13 groups of sports. A Kruskal-Wallis test provided very strong evidence of a difference (χ^2 = 69.175, df = 12, p = 0.000) between the mean ranks of at least one pair of groups. The lowest mean rank have fitness (505.983) and football (584.475) and the highest mean rank has tennis (1008.111). Pairwise comparison reveals that distribution of midterm mathematics grades in group of pupils who practice football significantly differs from ones that practice tennis, basketball, dance (p = 0.000) as well as volleyball and gymnastics (p<0.020). Same results appears for fitness and tennis (p = 0.000) as well as fitness and gymanstics (p = 0.031).

Obtained results indicate that distribution of school success is not favorable for football practicioners. It was interesting to check results for subsets of male and female pupils. For male pupils only one significant mean rank differece was found: between fotball and basketball (p = 001) in the case of general school success as well as mathematics achievement. For female pupils, test result showed no significant mean rank difference in the case of general school success (χ^2 = 18.165, df = 12, p = 0.111) as well as mathematics achievement (χ^2 = 20.232, df = 12, p = 0.063).

Finnaly, Wilcoxon signed-rank tests was conducted to determine if there is significant difference in midterm general school success and mathematics achievement in each category of pupils: non-sport, active and recteative sports participants, individual sports and team sports participants. Wilcoxon signed-rank tests indicated that there are significant differences between the general and math midterm achievement in each of categories of pupils regarding participation in extracurricular activities (p = 0.000). Midterm general school success is better than mathematics achievement no matter if middle school pupils participate in sports activities or not. (Table 14).

Table 14. *Differencies among general and math midterm achievement*

activity	Midterm achievement	Mean rank	z	p
none/ non-sports	general	237.52	-14.129	**.000**
	math	189.84		
active	general	221.72	-16.177	**.000**
	math	186.60		
recteational	general	202.71	-14.269	**.000**
	math	177.14		
individual	general	134.26	-12.750	**.000**
	math	124.64		
Team	general	290.18	-17.385	**.000**
	math	243.44		

The benefits of physical activity and/or phisical fitness are widely acknowledged and extend across many domains of wellness. The association between physical activity and academic achievement, however, remains to be clarified, especially in young children and preadolescent. In various studies it is determined that regular physical activity is associated with improved academic outcomes in school-age youth (Shephard at al, 1984, Donnely at al, 2011, Donnelly at al, 2016, Pjanic at al, 2021). This contention is supported by studies which indicate that students who perform more hours of physical activity and/or more intense physical activity have better academic achievement than those who are less physically active (Castelli et al., 2007, Eveland-Sayers, 2009, Bass at al, 2013, De Greeff at al, 2014). Results of this study supports could be added to results of mentioned studies that find positive accociations between physical activity and academic achievement. On the other hand, other relevant studies determined no association or

negative associtation between physical activity and academic achievement. Meta-analysis of cross-sectional observations showed a positive association between academic performance and physical activity, but at the same time showed that physical fittnes did not seem to show such an association (Trudeau and Shephard, 2008). Martin at al (2018) found that physical activity-only interventions had no statistically significant beneficial effect for mathematics and reading achievement. Furthermore, there is insufficient evidence to conclude that additional physical education time increases academic achievement; however there is no evidence that it is detrimental (Keeley & Fox, 2009).

This study shows that middle school pupils who are engaged actively in sports have signifficantly better general school succes and mathematics achievement then other pupils. Results of this study conform to Stevens at al (2008) findings indicated that engagement in physical activity of fiftgraders was more positively influential on math achievement. They are also in line with Grissom (2005) findings that indicated positive relationship between physical fitness and academic achievement. On the other hand, results of this study differ from findings of Donnelly at al (2016) stating that physical activity and physical education have a neutral effect on academic achievement.

Sember at al (2020) indicated that academic performance itself is not solely caused by increased physical activity. Present study indicated positive associations between participation in active involvement in both team and individual sports with general school success and mathematics achievement. However, the aim of this study was not determination of causal connections. We can guess that pupils involved in organized sport are aware of how much time they will spend training or competing, and accordingly organize their time for learning. It is possible that active involvement in sports leads to better school performance, but it is also possible that better grades may inspire pupil to get involved into sports. However, no studies among middle school children have considered those associations.

Conclusions

Through our research, we found differences in academic achievement between pupils who do not participate in extracurricular sports activities and students who are engaged in sports, either actively or recreationally, whether participating in team or individual sports. Differences do not occur between pupils who are engaged in sports actively and those engaged in sports recreationally, as well as between participants in team or individual sports. Based on the analysis of the results obtained for male and female pupils, it can be concluded that in all comparative groups, both boys and girls, there are statistically significant differences in midterm general school success and mathematics achievement, except between girls engaged in sports recreationally and those who are not involved in sports. Test results show that both male and female middle school pupils who are actively involved in sport show better general midterm success as well as mathematics achievement compared to other categories of pupils.

Also, pupils participate in team sports, as well as pupils who participate in individual sports obtain better general midterm school success and achieve more in mathematics than pupils who are not engaged in sports. However, there is no difference in midterm school success (general and mathematics) between pupils who participate in team sports and those who participate in individual sports. This stands for both male and female middle school pupils. Furthermore, pupils who practice football were found to have lower school performance compared to pupils who practice some of the other sports. These results raise questions for further research. Some of these issues are to determine the dependence of school success on engaging in different modes and types of sports activities. It is possible for academically less successful pupils to choose a particular mode, type or kind of sport. It is also possible that participation in a particular regime of sporting activities contributes to better school success. We can get answers to these questions by further research.

References

Bass RW, Brown DD, Laurson KR, Coleman MM. (2013). Physical fitness and academic performance in middle school students. *Acta Paediatr.*; 102(8), 832-837. doi: 10.1111/apa.12278.

Castelli DM, Hillman CH, Buck SM, Erwin HE. (2007). Physical fitness and academic achievement in third- and fifth-grade students, *J Sport Exerc Psychol.*; 29(2), 239-252. doi: 10.1123/jsep.29.2.239.

Cox, R.H. (2012). *Sport psychology: concepts and applications*, McGraw-Hill, New York,.

De Greeff JW, Hartman E, Mullender-Wijnsma MJ, Bosker RJ, Doolaard S, Visscher C. (2014). Physical fitness and academic performance in primary school children with and without a social disadvantage. *Health Educ Res.*; 29(5), 853-860. doi: 10.1093/her/cyu043.

Donnelly JE, Lambourne K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Prev Med.*; 52 Suppl 1, 36-42. doi: 10.1016/j.ypmed.2011.01.021. PMID: 21281666.

Donnelly JE, Hillman CH, Castelli D, Etnier JL, Lee S, Tomporowski P, Lambourne K, Szabo-Reed AN. (2016). Physical Activity, Fitness, Cognitive Function, and Academic Achievement in Children: A Systematic Review. *Med Sci Sports Exerc.*; 48(6), 1197-1222. doi: 10.1249/MSS.0000000000000901

Dyer, AM, Kristjansson, AL, Mann, MJ, Smith, ML, Allegrante, JP. (2017). Sport Participation and Academic Achievement: A Longitudinal Study. *American journal of health behavior*, 41(2), 179–185. https:// doi.org/10.5993/AJHB.41.2.9 PMID: 28452695.

Esteban-Cornejo, I, Tejero-González, CM, Martinez-Gomez, D, Del-Campo, J, González-Galo, A, Padilla-Moledo, C, ...Veiga, OL (2014). Independent and combined influence of the components of physical fitness on academic performance in youth. *The Journal of Pediatrics, 165*(2), 306-312. doi:10.1016/j.jpeds.2014.04.044

Eveland-Sayers BM, Farley RS, Fuller DK, Morgan DW, Caputo JL. (2009). Physical fitness and academic achievement in elementary school children. *J Phys Act Health;* 6(1), 99-104. doi: 10.1123/jpah.6.1.99. PMID: 19211963.

Field, T, Diego, M & Sanders, CE (2001). Exercise is positively related to adolescents' relationships and academics, *Adolescence,* 36, 105–110.

Grissom, JB (2005). Physical fitness and academic achievement. *Journal of Exercise Physiology,* 8, 11-25.

Keeley, TJH & Fox, KR (2009). The impact of physical activity and fitness on academic achievement and cognitive performance in children, *International Review of Sport and Exercise Psychology,* 2:2, 198-214, DOI: 10.1080/17509840903233822

Lau, WC, Yu, CW, Lee, A, So, RCH & Sung, RYT (2004). The relationship among physical fitness, physical education, conduct and academic performance of Chinese primary school children, *International Journal of Physical Education,* 41, 17–26.

Martin A, Booth JN, Laird Y, Sproule J, Reilly JJ, Saunders DH. (2018). Physical activity, diet and other behavioural interventions for improving cognition and school achievement in children and adolescents with obesity or overweight. *Cochrane Database Syst Rev.*, 29; 1(1): doi: 10.1002/14651858.CD009728

Pjanić, K, Nikšić, E, Nesimović, S (2021). Effects of sports and mathematics extracurricular and club activities on academic achievement of middle school pupils, *Journal Anthropologie,* Vol. 59, Issue 1, 111-120. DOI: https://doi.org.10.26720/anthro.20.01.29.1

Sember V, Jurak G, Kovač M, Morrison SA, Starc G (2020). Children's Physical Activity, Academic Performance, and Cognitive Functioning: A Systematic Review and Meta-Analysis. *Front. Public Health 8, 307. doi: 10.3389/fpubh.2020.00307*

Shephard RJ, Volle M, Lavallee H, LaBarre R, Jequier JC, Rajic M (1984). Required physical activity and academic grades: a controlled study. In: Ilmarinen J, Välimäki I, editors. *Children and Sport*. Berlin: Springer, 58–63. doi: 10.1007/978-3-642-69465-3_8

Stevens, TA, To, Y., Stevenson, SJ, Lochbaum, MR (2008). The Importance of Physical Activity and Physical Education in the Prediction of Academic Achievement, *Journal of Sport Behavior,* Vol. 31, No. 4, 368-388.

Trudeau, F, Shephard, RJ (2008). Physical education, school physical activity, school sports and academic performance. *Int J Behav Nutr Phys Act* **5,** 10. https://doi.org/10.1186/1479-5868-5-10

Varešlija, F, Palić, A (2012). Utjecaj bavljenja sportom na uspješnost ostvarenog učinka u školi. *Sportski logos*, 19, 71-76.

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