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Physical activity and academic performance in students from same primary education school

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Abstract

Background and Study Aim: Recent researches has demonstrated the relationship between physical activity levels and academic performance in schoolchildren. Most of them have sampled students from different schools and cities. Sometimes academic performance was influenced by other factors such as the type of teaching, the teaching staff or, for example, the assessment system. This research has tried to associate the practice of out-of-school physical activity with academic performance in a group of students, with the peculiarity that they all belonged to same Elementary school.

Material and Methods: 120 students (67 boys and 53 girls), aged between 8 and 12 years, participated in this study once their parents or guardians were informed about the characteristics of the study. Academic performance was calculated from the average grades provided by their teachers in the first term. Physical activity levels were calculated using the APALQ questionnaire, categorising students into two types: active or sedentary. In the presence of a normal distribution, the difference between groups was obtained using Chi-Square and Student's t-test. In those cases where the distribution was not normal, comparison was carried out using the Mann Withney U.

Results: The analysis of results showed that active students obtained significantly higher grades than sedentary students (8.15±1.17 vs. 7.35±1.15; p=0.042). This circumstance is maintained when analysing the results according to the students' gender, although it is only significant in the case of girls (8.08±1.22 vs 7.03±0.87; p=0.036).

Conclusions: The practice of physical activity during non-school hours had a positive influence on the academic performance of the students analysed, even though they were from the same school.

Keywords: academic performance, physical activity levels, children, physical education, extra-curricular sports, healthy habits.

Introduction

This research aims to demonstrate the relationship between the practice or extra-curricular physical activity and academic performance in children belonging to the same primary school. To this end, the academic averages obtained by a group of students from third to sixth grade will be analysed. Results are shown according to children physical condition: sendentary versus active.

It is considered that childhood is a key stage in which children form healthy habits or acquire new knowledge, as their personality is in the process of formation [1, 2]. Along this lines, Gámez-Calvo et al. [3] stated that during this period students' concept of personal identity is strengthened, thus creating conditions for them to learn useful habits that they can incorporate into their lifestyles for adulthood.

In the same work, Gámez-Calvo et al. argued that the academic performance of our schoolchildren could be influenced by different variables, all of which are connected to students' lifestyles [3]. For example, Lee et al. [4] found a direct relationship between sleeping hours and academic performance, while Kristjánsson et al. [5] linked it to students' eating habits or even body mass index. However, in recent years, there has been a trend to analyse whether physical exercise might be related to better school success, leading to numerous systematic reviews linking these variables [6, 7, 8, 9].

It is clear that regular physical activity is essential for our schoolchildren to achieve optimal growth and development [10, 11, 12]. Also, just as a decrease in levels of physical activity could have an impact on the physical and mental health of our students [13]. In terms of official recommendations for physical activity, national and international bodies agree that school children (6-12 years) should get at least 60 minutes of moderate to vigorous physical activity per day to improve their health and well-being [1, 10].

Therefore, we should ask ourselves whether this improvement in health promoted by physical exercise will be reflected in cognitive improvements in general and, particularly, in the academic performance of our students. Regarding cognitive improvements, Dywer [14] concluded that schoolchildren who exercised were more responsible and respectful of the rules. Rosa-Guillamón et al. [15] also observed improvements with respect to group work with peers, as well as greater organisational skills. Finally, several researchers found that brains

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of children who engaged in systematic exercise were more stimulated, increased motivation towards academic contents and improved teaching and learning processes [16, 17, 18].

That regular practice of physical activity promotes better academic performance is a conclusion reached by numerous reviews of the literature on the subject [8, 9, 19, 20, 21]. Specifically, when analysing studies with Primary School students similar to ours, we highlight the most recent ones published in our country. Isorna et al. [22] found a significant relationship between practicing physical exercise and obtaining better grades in students aged 6 and 12 years. In another publication, with 223 students from 3rd to 6th grade of primary school, Prieto & Martínez [23] concluded that students who were more physically active had an increase in academic performance and had better grades in the area of mathematics. Pros et al. [24] indicated that the practice of extracurricular physical activity significantly affected academic performance in language, mathematics and languages, after analysing 518 primary school students.

With regard to research made out of Spain, Fritz et al. [25] established a positive relationship between physical exercise and academic performance in 338 children aged between 6 and 8 years. Faught et al. [26], after studying 4.253 pupils aged 10 and 11, concluded that an active lifestyle was associated with better grades, especially in mathematics. In the same way, Booth et al. [27] reported that physical activity predicted academic performance in English, mathematics and science in a study of 4.755 students aged 9, 10 and 11. Wang et al. [28] found a positive correlation between physical fitness and academic achievement after analysing 1.065 children from Taiwan.

In contrast, and in areas of study close to our research, there are also studies in which the authors found no causality between the practice of physical exercise and better grades in primary school students [29, 30, 31, 32]. In the light of the above, we consider it necessary to analyse whether the practice of extracurricular physical activity will have an effect on the academic performance of students.

Purpose of the Study. The study purpose was to identify the relationship between the practice of extra-curricular physical activity and academic performance in a group of students, all belonging to the same educational centre, a primary school in the city of Murcia, Spain.

Materials and Methods

Participants

This research was based on a descriptive, non-experimental, quantitative study. The sample belonged to a Primary School in the city of Murcia, Region of Murcia, Spain. A total of 120 children, 67 boys and 53 girls, aged between 8 and 12 years, participated in the study during the 2021/2022 school year. Before starting the data collection, the head teacher of the school was informed of the type of study to be carried out. The participating students were then asked to provide signed consent by their parents or guardians, who were previously informed of the characteristics of the study. This study has been approved by the University of Murcia's Research Ethics Commission (November 2021).

Research Design

The Assessment of Physical Activity Levels Questionnaire (APALQ), translated into Spanish and validated by Jurado-Castro et al. [33], was used to categorise whether or not students were physically active outside school. Students were considered "active" if they scored 11 or more points on the questionnaire. Regarding academic performance, the tutors of each year were asked for the report cards of the first term of the academic year, detailed by subject. As the students belonged to the same school, the results obtained allow us to link the study variables (physical activity and academic performance), eliminating the possible contaminating variables that could arise when using academic performance from different schools (different teachers, methodologies, textbooks or assessment systems, etc.).

Statistical Analysis

The data collected were analysed using IBM SPSS Statistics for Windows, Version 28.0 (Armonk, NY: IBM Corp). First, the normality of the data was analysed according to the different variables, using the Kolmogorov-Smirnov statistic. In the presence of a normal distribution, the difference between groups was obtained using Chi-Square and Student's t-test. In those cases where the distribution was not normal, the comparison between means was carried out using the Mann Withney U statistic.

Results

The purpose of this research was to analyse physical activity levels in primary school students and its relationship with their academic performance.

Firstly, with regard to the descriptive analysis (Table 1) of the physical activity variable, it was observed that, analysing the total number of pupils without distinction of gender, 80.8% of those surveyed were active, compared with 19.2% who were sedentary.

According to gender, this difference was not significant (Student T; p=0.061). 86.5% of boys did engage in physical activity, while this value fell to 72.6% of girls. Same circumstance was repeated in all grades where, although there was no significant difference by grade (p=0.603), the percentage of active pupils was higher than that of sedentary

pupils for every year (third, fourth, fifth or sixth).

Table 1. Out-of-school physical activity practice according to students' gender and scholar grade

Category	Sedentary	Active	Sig. (p)
All (n=120)	**23 (19.2%)**	**97 (80.8%)**	-
Gender			
Boys (n=67)	9 (13.5%)	58 (86.5%)	0.061
Girls (n=53)	15 (28.4%)	35 (72.6%)	
Year			
Third (n=33)	8 (24.2%)	25 (75.8%)	0.603
Fourth (n=26)	5 (19.5%)	19 (80.5%)	
Fifth (n=26)	3 (11.5%)	23 (89.5%)	
Sixth (n=35)	9 (25.7%)	26 (74.3%)	

On analysing the results according to year, we could see how, in all years, the percentage of children who practised PA outside school hours was higher in boys than in girls. In 5th grade of primary school, 100% of the male pupils participating in this study were considered "active". In any case, the chi-square statistic by year group also gave a value greater than 0.05, so that these differences were not significant according to gender and year group.

We then proceeded to study the relationship between physical exercise and academic performance of the participants. It was calculated that the academic average for physically active students was higher than for sedentary students (8.15±1.17 vs. 7.35±1.15). Furthermore, these differences were significant (p=0.042), which indicates that students who practised physical activity outside school hours had higher academic performance than sedentary ones (Table 2).

Table 2. Academic performance categorised by gender and students' year

Category	Average Grade – Sedentary Students		Average Grade – Active Students		Sig. (p)
	Mean	SD	Mean	SD	U Mann Withney
All (n=120)	**7.35**	**1.15**	**8.15**	**1.17**	**0.042***
Gender					
Boys (n=67)	7.74	1.29	8.14	1.13	0.408
Girls (n=53)	7.03	0.87	8.08	1.22	0.036*
Year					
Third (n=33)	7.50	1.15	8.82	0.68	0.002*
Fourth (n=26)	7.47	1.29	7.84	1.52	0.612
Fifth (n=26)	9.35	0.16	7.82	1.24	0.026*
Sixth (n=35)	7.57	0.75	8.13	0.99	0.099

*Significant Difference p≤0.05

When performing the same test, but differentiating the results according to the gender of the students (Table 2), it was observed that academic performance was better in both boys and girls for those students who practised physical activity outside school. Thus, the mean academic performance of boys who exercised was higher than that of sedentary students (8.14±1.13 vs. 7.74±1.29), although this difference was not considered significant (p=0.408). In the case of girls, the difference in academic performance between active and sedentary girls also occurred (8.08±1.22 vs. 7.03±0.87). Moreover, in this case, this difference was found to be significant (p=0.036).

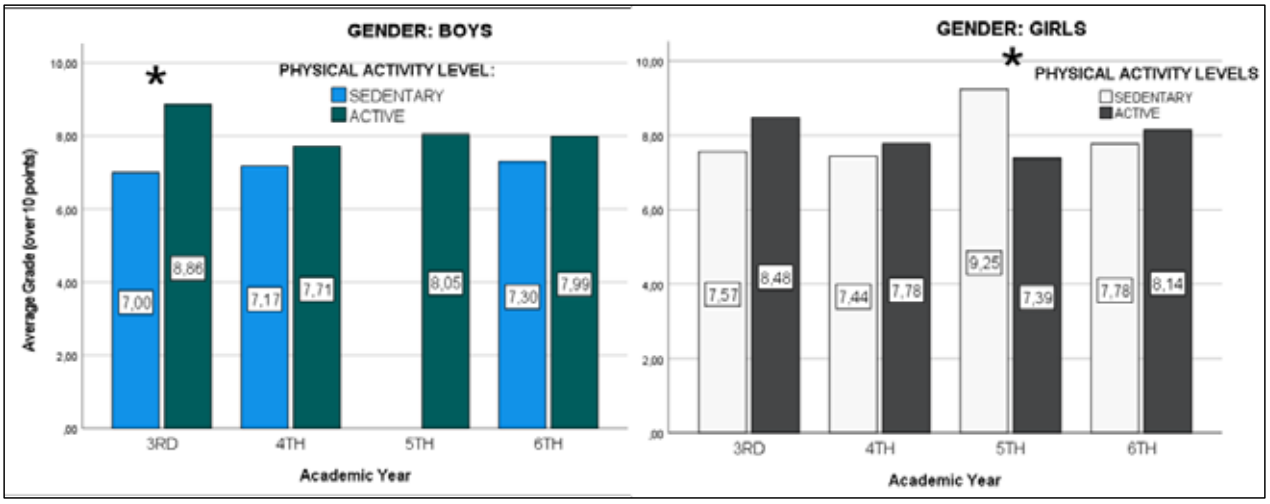
And as a function of year? In this case we again applied the Mann Withney U statistic because of the non-normal distribution of the results. Thus, as shown in Table 2, in 3rd grade the academic performance of those students who practised extracurricular physical activity was significantly higher in active students than in sedentary students (8.82±0.68 vs. 7.50±1.15), with a p-value of 0.002. In the 5th and 6th grades of primary school, the academic performance was higher in pupils who exercise, although these differences were not considered significant. It is noteworthy that, in the case of 5th grade of Primary, the difference is reversed. Students categorised as sedentary obtained a higher academic performance average than active students (9.35±0.16 vs. 7.82±1.24), being, moreover, significant (p=0.026).

Finally, for boys, the active students obtained better marks than the sedentary students (Fig. 1). Specifically, in the case of 3rd grade, this difference (8.86 vs 7.00) was significant, with a p-value of 0.041 after applying the Mann Withney U statistic. Analysing the girls by year, we can see that in the third, fourth and sixth years of primary school, the active girls obtained higher average marks, although this difference was not significant in any case. The fifth year of primary school stands out, where sedentary pupils obtained higher average marks (9.35) than active pupils (7.49), and this difference was significant (p=0.035).

Discussion

The purpose of this manuscript was to analyse the relationship between the practice of physical activity and academic performance in pupils belonging to the same primary school. Firstly, with regard to descriptive analysis, it was observed that most of the students from analysed school, 80.8%, engage in PA out of scholar hours compared to 19.2% of sedentary pupils. This data reveals that the percentage of physically active children is large, in line with recent research on the school population in our Spain [34, 35, 36].

In contrast, the values obtained in our school differ from those found by Alfonso-Rosa et al.[37],



*Significant difference p≤0.05

Figure 2. Academic performance as a function of physical activity level. Categorised by grade and gender of students

for whom, in the context of the same population group, most of the students studied were sedentary. As mentioned in the methodology section, the sample of this study belonged to the same school. Specifically, to a subsidised school in the centre of the capital of the Region of Murcia, Spain, where most families belonged to a medium-high socio-economic stratum. The economic level is linked to the levels of physical activity of schoolchildren [1, 38, 39]. In our case, the results obtained coincide with those published by Cano-Garciñuno et al. [40] and Ramos et al. [41] who, after analysing levels of sports practice according to the economic status of families, concluded that those students belonging to environments with greater purchasing power were significantly more physically active than the rest.

With regard to associating the level of physical activity with academic performance, we would like to mention, again, that, as the students belong to the same centre, results are not influenced by the type of institution, type of teaching staff, methodologies or type of assessment, among others [31, 42]. Therefore, we start from a homogeneous level of demand and assessment criteria, similar for all students and only differentiated by their grade. With this premise, the analysis of the results has allowed us to conclude that those students who practice exercise after school hours obtained higher academic performance compared to more sedentary students (mean score of 8.15±1.17 vs. 7.35±1.15) and, moreover, this difference was significant (p=0.042).

This circumstance coincides with most of the reviews published to date in Spain [43, 20]. Also in the international context [8, 9, 28], where it was concluded that higher levels of sports practice were positively associated with better academic performance.

Regarding foreign studies carried in Spain, with the condition of analysing students belonging to the same school, our conclusions coincide with Prieto & Martínez [23], who analysed 232 students from the same school where the best average grades (especially in mathematics) were obtained for students who accumulated higher levels of physical activity. The same conclusion was obtained by Alfonso-Rosa et al. [37] after studying the grades of 50 pupils aged 9-10 years in a school in Seville.

One explanation for these results can be found in the studies by Hillman et al.[44] and Ibáñez [45], who concluded that the fact of practising more hours of exercise did not affect a reduction in study hours in children and adolescents. As indicated by WHO [1] and Luque et al. [20], systematised physical activity contributes to the development and maintenance of the cognitive functions of students. It will be reflected in their better academic performance, compared to those students who only participate in academic activities [46].

In terms of gender, active boys obtained better results than sedentary (8.19±1.13 vs. 7.79±1.31). This was repeated in girls (8.02±1.22 vs. 7.03±0.87) where, moreover, the differences were statistically significant (p=0.036). Several publications show similar results. Hernández & Pórtoles [47] and Álvarez-Bueno et al. [48], established a direct relationship between the practice of physical exercise and academic performance, with significant results in the case of girls. In a previous study, Calvo-Pacheco et al. [49] with schoolchildren in Tenerife (Spain) observed that, within the group of physically active students, girls obtained significantly better grades than boys. In contrast, our results differ from those published by Ávila-García et al. [50], who, after analysing the results of 152 students in the second year of primary school, found that, in the case of girls, academic performance was inversely

proportional to exercise.

Finally, the results were analysed according to the academic year of the students. Thus, we were able to observe how in 3rd year, academic performance in those students who practise PA is significantly higher in active students than in sedentary students (8.66±0.87 vs. 7.26±1.21), with a p-value of 0.024. This was similar in 5th and 6th year, although the differences were not significant. In this sense, there are few studies that have analysed this variable according to the students' year of study. Even so, in the research by Sibley & Etnier [51], it is observed that the differences in grades between active and sedentary students become greater as they advance in age and the grades become more demanding. This fact is even more important in our case, since we are dealing with the same school where the differences in terms of demands, teachers and methodology are more evident from year to year.

Conclusions

The school students analysed in this study with higher levels of physical activity out of school hours obtained significantly better academic performance than those who were more sedentary. This situation was maintained when analysing the results according to gender, and was statistically significant in the case of girls. The analysis by grades showed a positive relationship between exercise and better grades in three of the four grades analysed (third, fifth and sixth year of Primary Education).

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