

Article

Modeling Physical Activity, Mental Health, and Prosocial Behavior in School-Aged Children: A Gender Perspective

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Abstract: The purpose of this study was to examine the link between physical activity (PA) and mental health (MH) in children in terms of gender. A total of 750 subjects (52.9% boys, $M_{age} = 10.88$; $SD = 0.75$) reported the level of PA they were performing by means of a self-report questionnaire, and they also completed the Spanish version of the Strengths and Difficulties Questionnaire (SDQ). Results revealed statistically significant differences in regard to gender in the physical activity index (PAI), the externalizing of problems, and prosocial behavior. Boys presented high scores on the PAI and externalizing problems. Girls obtained higher values on the prosocial scale. In the prediction analysis, the PAI revealed a statistically significant relationship in linear models for externalizing and internalizing problems, as well as in both the linear and quadratic models in the prosocial scale for the case of male gender. For girls, the PAI revealed a statistically significant relationship in the quadratic model for internalizing problems and in both the linear and quadratic models for the prosocial scale. These findings are discussed in terms of previous research literature on PA and MH in children. Some important educational implications for teaching and learning physical education are suggested.

Keywords: physical activity; mental health; prosocial behavior; school; children

1. Introduction

1.1. Physical Activity (PA) and Mental Health (MH)

Recent reports from the WHO in 2019 have highlighted two extremely relevant issues. First, more than 80% of the global adolescent population do not have a sufficient level of physical activity (PA). The recommendation sets out performing at least 60 min a day of moderate or vigorous PA for children and adolescents aged 5 to 17. Second, it is estimated that between 10% and 20% of adolescents have mental health (MH) issues that are not diagnosed or treated correctly (e.g., anxiety, stress, depression).

Specific literature has analyzed the twofold role that performing PA regularly can play on physical and mental health (PH and MH). The benefits of performing PA regularly on PH have been well documented by research [1], in addition to the negative consequences of physical inactivity [2]. There is also accredited research on the positive contribution of PA on MH [3], with PA at the same time constituting a protective variable against the onset of MH illnesses in children and adolescents [4].

Two major sets of investigations have emerged under this framework of reference: (i) studies that focused on the role played by PA in the psychological ill-being of young people (depression, anxiety, stress) and (ii) investigations that focus their analysis on the role of PA on the psychological well-being of children and adolescents (self-esteem, self-concept, satisfaction with life, happiness).

Recently, a review of reviews with the aim of summarizing existing literature on PA, sedentary behavior (SB), and MH in young people was performed [5]. During this update, a small, albeit significant positive effect of PA on MH was detected. The association between an increase in SB, especially excess screen time and poor levels of MH, was also notable.

An updated review of reviews performed by Biddle et al. [6] about PA and MH in children and adolescents found positive causal relationships, in part, for depression and not for self-esteem. For its part, the systematic review performed by Dale et al. [7] reveals that more robust positive evidence of PA on MH lay in depressive symptoms. There are also studies that support the positive relationship between the increased volume of PA and higher levels of happiness [8].

1.2. *This Study*

Despite there being more robust evidence that revealed that PA is associated with good MH in children and adolescents [9], the levels of performing PA are different according to gender. Recent findings revealed that the percentage of girls performing insufficient PA is greater than that of boys [10].

However, in regard to MH (emotional and behavioral problems) much of the research confirms that boys obtain a higher score for external symptoms such as behavioral problems and hyperactivity, whilst girls obtain a higher score for internalizing symptoms and prosocial behavior (actions aimed at helping, sharing, or cooperating with others) [11–15]. However, studies also exist in which no differences in terms of gender were observed [16,17].

The analysis on the state of the matter suggests a need to perform studies that reveal new evidence and clarify the association of the PA and MH binomial, as well as studies that consider gender as a moderating variable in this relationship. Currently, there are no studies that have analyzed the role of PA on MH in boys and girls using the Strengths and Difficulties Questionnaire [18]. Therefore, the purpose of this research is to examine the association between PA and MH in primary school children in terms of internalizing problems (emotional problems and problems with peers) and externalizing problems (hyperactivity and behavioral problems). In addition, the prosocial scale is included.

2. Materials and Methods

2.1. *Sample*

A total of 750 students took part in this study. Mean age was 10.88 years (SD = 0.75; range 9–13), with 47.1% girls (n = 353) and 52.9% (n = 397) boys. The sample was selected by means of means clustering, the sampling of various ages plus the random selection of school classes in schools with more than one group for 5th and 6th grades (primary school). Cluster sampling was performed after randomly selecting 12 schools from the Autonomous Community of Extremadura (Spain). Half the sample (50.4%) is in 5th grade and the other half (49.6%) in 6th grade.

2.2. *Data Collection Instruments*

2.2.1. Physical Activity Self-Report, APALQ [19]

The level of performing PA was measured subjectively by means of a self-reported measurement with the tailored Spanish version of the “Assessment of Physical Activity Levels Questionnaire” [20]. The Spanish version of this questionnaire was validated by Zaragoza, Generelo, Aznar, Abarca, Julián, and Mota [19], and it exceeded the concurrent validity test to which it was subjected in contrast to objective measurements using accelerometry. This is, therefore, a valid and reliable instrument to measure the level of performing PA in children and adolescents.

The questionnaire comprised five questions that refer to different aspects related to performing PA and sport: (1) Outside school, do you take part in organized sport?; (2) Outside school, do you take part in nonorganized sport?; (3) In physical education classes, how many times a week do you take part in sport or physical activity for at least 20 min?; (4) Outside school, how many hours a week do you usually take part in physical activity to the extent that you get out of breath or sweat?; and (5) Do you take part in competitive sport?

Questions 1, 2, and 5 have four possible answers that vary from 1 to 4 where one represents the least level of performing PA and four the greatest. In questions 3 and 4, we can find up to 5 possible answers that vary from 1 to 4. The two options that entail less implication performing PA are assigned a value of 1, the third option the value 2, and the fourth and fifth options, the value 3 and 4, respectively. The total score corresponds to the sum of the five questions, and a PA index can be obtained with a minimum and maximum value of 5 and 20 points, respectively. To process data, the continuous PA index (PAI) was used as in other previous studies [21].

2.2.2. Strengths and Difficulties Questionnaire (SDQ) [18]

The SDQ questionnaire is a sensitive evaluation, and it appears highly suitable to identify mental disorders in adolescents. All scales offer a high index of internal consistency on a global level [22,23] and on the scale validated in Spain [24]. The test comprised 25 items, structured into 5 factors: emotional symptoms, behavioral problems, peer relationship problems, hyperactivity/attention deficit, and prosocial behavior. Each scale comprised 5 questions with Likert-type answers of 3 possible scores (where 0 is “not true”, 1 “somewhat or sometimes true”, and 2 “very true or often true”). When the sample is a group, we obtain a new scale called externalization problems using the scales of behavioral problems and hyperactivity/inattention [25]. Moreover, the emotional symptoms and peer relationship problems scales are combined into the internalization of problems scale [26]. Higher scores indicate poorer MH.

The SDQ total score and the score for each scale are catalogued into 3 possible options: “normal”, “subclinical”, or “clinical”. According to the original scale [27], the clinical category is 10% higher in cases (percentile ≥ 90 th) than other categories. However, the subclinical category in cases is between the 80th and 90th percentiles. We obtain an overall score with 4 scales, and this is not considered prosocial behavior. The overall reliability of the scale leads to a Cronbach’s alpha (α) of 0.76 and a composite reliability (CR) of 0.81; the scale of externalization problems has an α of 0.72 and a CR 0.77; the internalizing problems scale produces α 0.74 and a CR 0.73. The confirmatory factor analysis presents a good fit (CFI = 0.97, TLI = 0.98, RMSR = 0.031, RMSEA = 0.022).

2.3. Procedure

This study was positively evaluated by the University of Extremadura Bioethics and Biosafety Committee (N^o. 0063/2018). To carry this out, there was compliance with the ethics principles and the code of conduct of the American Psychological Association (2010), and all parents signed informed consent for minor children. The first step was to visit the schools with the aim of presenting the study and obtain approval so that the student body could answer the questionnaires. In this situation, data could always be obtained with one of the qualified researchers present in the classroom. Second, confidentiality and anonymity criteria were compliant for each student, and all answers and data were single use for the aims of this study. To fill in the reports, each student took a mean of 20 min. This was during school hours and under optimal conditions to focus attention on the questionnaire.

2.4. Data Analysis

Prior to the statistical analysis, a missing data analysis was performed with the variables included in the models under study. These statistical analyses were performed with the SPSS suite, PC v. 21.0. Previous tests (Kolmogorov–Smirnov, Rachas, Levene) advised the use of parametric statistics ($p > 0.05$). They consisted of an instrument reliability analysis, a student *t* test to compare the difference in means between the two genders, a Pearson correlation, and a linear and quadratic regressions analysis.

3. Results

First, possible differences in gender were analyzed in the average scores for PAI as well as the internalizing and externalizing problems on the prosocial scale. A comparison of means (Table 1) reveals the existence of statistically significant differences in gender ($p < 0.001$) in the PAI, the externalizing problems scale, and the prosocial scale. Boys obtain higher scores on the PAI and externalizing problems, and girls a higher score on the prosocial scale.

Table 1. Description and comparison of gender (student *t* test) of the PAI, externalizing and internalizing problems, and the prosocial scale.

Variables	Girls		Boys		<i>t</i>	<i>p</i>
	M	SD	M	SD		
Physical activity index	12.92	2.74	13.94	2.88	−5.172	< 0.001
Internalizing problems	3.52	2.77	3.67	2.91	−0.767	0.444
Externalizing problems	4.85	3.18	5.69	3.34	−3.596	< 0.001
Prosocial scale	8.76	1.53	8.32	1.53	4.102	< 0.001

In addition to the aim of identifying the association between PAI with externalizing and internalizing problems on the prosocial scale, and considering the differences in gender detected (Table 1), correlations were made between these variables differentiated by gender. The correlations (Table 2) reveal the existence of significant direct relationships (low) between the PA index and the externalizing problems in boys and with the prosocial scale in both genders.

Table 2. Pearson correlation PAI, externalizing and internalizing problems, and prosocial scale.

Variables	Physical Activity Index	Externalizing Problems	Internalizing Problems	Prosocial Scale
Physical activity index	1	0.039	−0.058	0.205 *
Externalizing problems	0.201 *	1	0.423 **	−0.360
Internalizing problems	−0.097	0.377 **	1	0.164 *
Prosocial scale	0.278 **	−0.271	−0.164	1

Above the intersection = girls; under the intersection = boys. * The correlation is statistically significant at the level 0.05 (bilateral). ** The correlation is statistically significant at the level 0.01 (bilateral).

However, with the aim of confirming whether the PAI can significantly predict externalizing and internalizing problems and prosocial behavior, and given the patterns of correlation observed (Table 2), regression analyses differentiated by gender were performed.

Moreover, considering the existence of no associations between variables included in the regression models and given the possibility of hypothetical nonlinear relationships, the linear and quadratic regression analyses that seek a possible curvilinear relationship are considered (Table 3).

Table 3. Summary of the models and estimates of linear and quadratic parameters by gender.

Dependent Variable	Equation	Girls						Boys					
		Summary of the Model			Estimates of the Parameters			Summary of the Model			Estimates of the Parameters		
		R ²	F	<i>P</i>	Constant	b1	b2	R ²	F	<i>P</i>	Constant	b1	b2
Externalizing problems	Linear	0.001	0.563	0.454	4.287	0.045		0.010	4.105	0.043	4.074	0.116	
	Quadratic	0.010	1.865	0.156	8.819	−0.699	0.029	0.011	2.243	0.108	2.490	0.370	−0.010
Internalizing problems	Linear	0.003	1.239	0.266	4.279	−0.059		0.009	3.955	0.048	5.053	−0.099	
	Quadratic	0.033	6.151	0.002	11.753	−1.285	0.048	0.009	1.873	0.155	4.988	−0.089	0
Prosocial scale	Linear	0.011	4.329	0.038	7.984	0.059		0.032	13.748	0	7.008	0.094	
	Quadratic	0.030	5.927	0.003	4.708	0.594	−0.021	0.034	7.328	0.001	5.937	0.265	−0.006

Independent variable: physical activity index.

Table 3 shows that the PAI in boys revealed a statistically significant association ($p \leq 0.05$) firstly in the linear models for externalizing and internalizing problems, and secondly in both models a linear and quadratic relationship in the prosocial scale which presented similar adjustments. As for girls, the PAI revealed a significant relationship for the quadratic model for internalizing problems and in both models a linear and quadratic relationship on the prosocial scale, which presented better adjustment for the quadratic model.

Figure 1 shows linear regression lines and quadratic regression curves. For linear regression lines, although not all are statistically significant, we observe similar patterns in boys and girls for the associations between the PAI and externalizing and internalizing problems, which are very similar in relation to the prosocial scale. As for quadratic regression curves, we appreciate a pattern according to which girls with extreme scores (minima or maxima) on the PAI will obtain higher scores for externalizing and internalizing problems and lower scores on the prosocial scale.

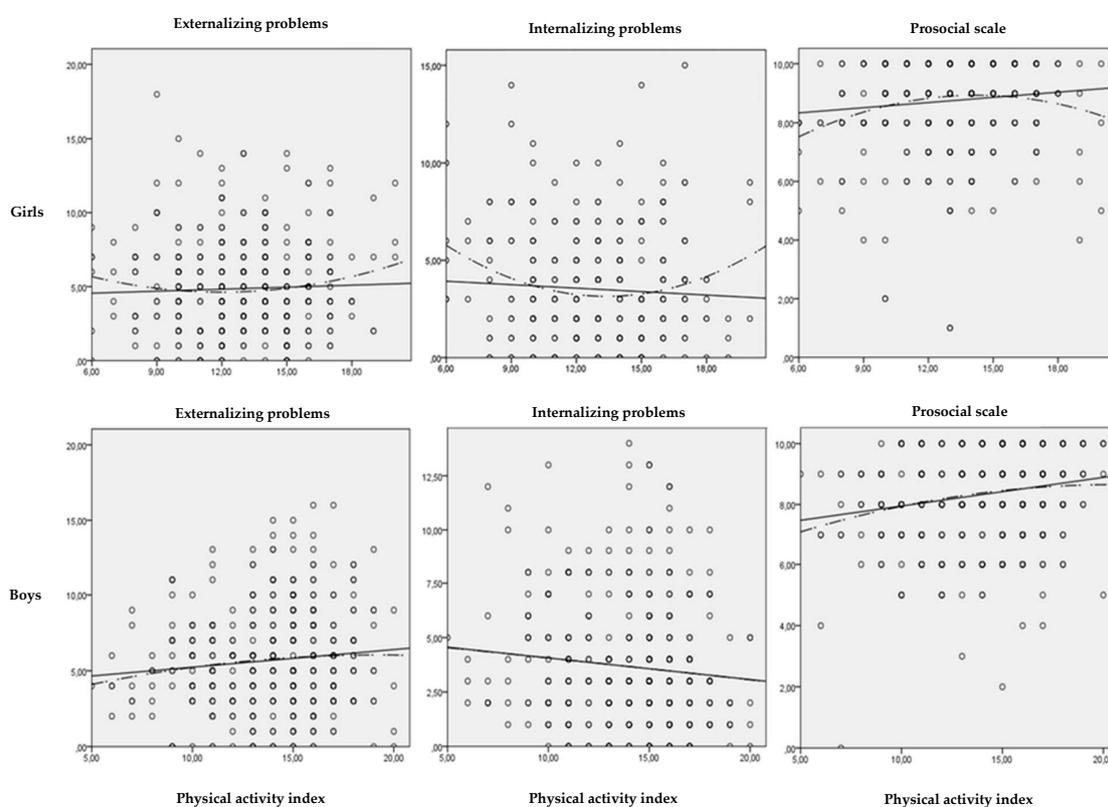


Figure 1. Graphs of predictions for linear and quadratic models.

4. Discussion

The aim of this study was to analyze the association between PA and MH in schoolchildren under the conceptualization arising from the SDQ [18]. Taking into account that previous studies detected gender differences for these two variables separately, the initial comparative data analysis enabled us to examine the degree of concordance between the results obtained in our investigation and the findings detected in previous studies.

Therefore, with regard to PAI and externalizing problems, we observe that boys presented significantly higher values in comparison to girls. These data are in accordance with the results obtained in previous research [9]. A similar thing occurred with the prosocial scale. Previous studies have indicated higher values for girls. References [11–13] and the data from our study have also corroborated these higher scores for girls. However, for the case of internalizing problems, no significantly different values were found between boys and girls. These results differ with regard

to other previous studies where it was indicated that the female gender presented higher indices of internalizing problems [14,15]. These differences were not detected in other studies either [16,17].

An important finding is the positive and significant association found between the PAI and the prosocial behaviors for both genders. It is suggested that a higher participation in physical activities boosts development of more prosocial behaviors related to the psychological well-being among schoolchildren [5]. This association was also confirmed in the linear regression performed where PAI revealed significant predictions on prosocial behaviors. Moreover, the quadratic regression analysis also revealed the existence of a significant curvilinear relationship in the form of an inverted “U”. These results in regard to curvilinear estimates suggest possible negative effects or at least not positive for low and high levels of PAI on prosocial behaviors.

The comparison between linear estimates detected in boys and girls on PAI and externalizing problems reveals two very different realities. The PAI positively and significantly predicts externalizing problems in the case of boys, and there is no significant relationship from the group of girls. It is suggested that hyperactivity and behavioral problems may be related to a greater need of boys to perform physical activity. For the case of girls, perhaps this absence of association may be accounted for by better levels of mental health presented by girls in regard to externalizing problems [11–13].

However, internalizing problems were negatively and significantly predictive for PAI in the case of boys. This aspect appears to indicate that high levels of PAI may positively contribute to reducing emotional problems and problems with peers. Although for the case of girls no significant linear prediction was detected, a significant curvilinear prediction was revealed in the form of “U” where intermediate levels of PAI suggest possible beneficial effects on emotional problems and problems with peers.

Study Limitations and Future Directions

This study has several limitations, most notably the use of self-reports to assess both mental health problems and physical activity. We believe it would be necessary to rely on other informants in addition to participants themselves. This was a transversal study; therefore, causal associations cannot be made. Likewise, the sample used and its size restrict the generalizability of the results. Another limitation worth noting is that no covariates were used in the regression models. Factors like BMI, socioeconomic status, and parental physical activity levels could have been important to consider. Future research should address these issues.

5. Conclusions

The results of the study enable drawing some conclusions and significant implications. The association between levels of PA and MH of schoolchildren is controversial, but the results detected suggest that a higher PAI is related to a better state of MH. First, in general, and regardless of gender, schoolchildren that perform more PA present higher prosocial behaviors, although the association between these two variables may be better explained in curvilinear form. Secondly, there also appears to exist a positive correlation of PA with internalizing problems, which in the case of boys is accounted for linearly and in the case of girls presents a better adjustment in the form of a curve.

With the aim of contributing to the improved state of MH in schoolchildren, it is suggested that teachers of physical education, monitors and trainers in the field of school sport, public administration, and private entities promote performing PA among boys. Moreover, it would be appropriate to further promote performing PA among girls due to the much lower participation.

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