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Original/*Deporte y ejercicio*

Straight-A students dislike physical education in adolescence: myth or truth? The AVENA, AFINOS and UP&DOWN studies

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Abstract

Objective: **to examine if those adolescents who dislike physical education classes get better results on academic and cognitive performance than their peers.**

Methods: **participants included 4 226 adolescents from the AVENA, AFINOS and UP&DOWN studies. Physical education enjoyment was assessed with a 7-point Likert scale. Cognitive performance in the AVENA study was assessed using the Spanish version of the SRA Test of Educational Ability. Academic performance in the AFINOS and UP&DOWN studies was assessed through Mathematics and Language grades and the average of both subjects.**

Results: **in the AVENA study we found differences in verbal ability among girls who dislike physical education and their peers ($P = 0.033$). In the AFINOS study, boys who dislike physical education had higher scores in Language than their peers ($P = 0.024$). In the UP&DOWN study girls who disliked physical education had higher scores in Language and in the average of Language and Mathematics than their peers ($P < 0.001$).**

Conclusion: **in the AVENA and AFINOS studies adolescents who disliked physical education had similar results in cognitive and academic performance than their peers, but in the UP&DOWN study girls who disliked physical education showed higher results in academic performance than their peers.**

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Key words: *Physical education. Enjoyment. Cognitive performance. Academic performance. Adolescents.*

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A LOS MEJORES ESTUDIANTES NO LES GUSTA LA EDUCACIÓN FÍSICA DURANTE LA ADOLESCENCIA ¿MITO O REALIDAD? LOS ESTUDIOS AVENA, AFINOS Y UP&DOWN

Resumen

Objetivo: **conocer si a aquellos adolescentes que no les gusta la educación física obtienen mejores resultados en rendimiento académico y cognitivo que sus compañeros.**

Métodos: **los participantes incluyen 4.226 adolescentes de los estudios AVENA, AFINOS y UP&DOWN. El gusto por la educación física se valoró con una escala Likert de 7 puntos. El rendimiento cognitivo se valoró en el estudio AVENA usando la versión española del SRA *Test of Educational Ability.* El rendimiento académico se valoró en los estudios AFINOS y UP&DOWN con las notas de Matemáticas, Lengua y la media de Lengua y Matemáticas.**

Resultados: **en el estudio AVENA encontramos diferencias en la habilidad verbal entre las chicas a las que no les gustaba la educación física y sus compañeros (P = 0,033). En el estudio AFINOS los chicos a los que no les gustaba la educación física tenían mejores notas en Lengua que sus compañeros (P = 0,024). En el estudio UP&DOWN las chicas a las que no les gustaba la educación física obtuvieron mejores resultados en Lengua y en la media de Lengua y Matemáticas (P < 0,001).**

Conclusion: **en los estudios AVENA y AFINOS los adolescentes a los que no les gusta la educación física obtuvieron resultados similares a los que sus compañeros, mientras que en el estudio UP&DOWN las chicas a las que no les gustaba la educación física obtuvieron mejores resultados en rendimiento académico que sus compañeros.**

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Palabras clave: *Gusto. Educación física. Rendimiento académico. Rendimiento cognitivo. Adolescentes.*

Introduction

Physical education (PE) is one of the main agents to promote physical activity (PA) among youth[1]. PE is, as well, an important source of PA for many adolescents, especially for those who do not engage regularly in PA. Dislike PE could limit their physical involvement in PE classes and their learning to be active outside school. In PE settings there is the myth that students with higher levels of academic and cognitive performance than their peers dislike PE because they would prefer to improve their cognitive skills rather than motor skills during school hours. Previous studies have attempted to identify potential socio-demographic (e.g. age, gender)[2], physical (e.g. physical fitness and fatness)[2,3,4], and environmental characteristics (e.g. school)[4] of students who dislike PE. However, to the extent of our knowledge, there is no study that has investigated whether students with better academic and cognitive results dislike PE classes. If this myth is finally confirmed, these students would be a target group for PA promotion strategies. Hence, the aim of this study is to examine if those adolescents who dislike PE classes get better results on academic and cognitive performance than their peers.

Methods

Participants of this study were part of three different studies: the AVENA study, the AFINOS study and the UP&DOWN study. The AVENA study is a cross-sectional study designed to assess health and nutritional status in a representative sample of adolescents (n=2859) from five Spanish cities (Granada, Madrid, Murcia, Santander and Zaragoza) between 2000 and 2002. The AFINOS study assessed a selection of lifestyle and health indicators through survey completed by a representative sample of adolescents from the Madrid region (n=2400) between 2007 and 2008. The UP&DOWN study is an ongoing 3-year longitudinal study designed to assess the impact over time of PA and sedentary behaviors on health indicators, as well as to identify the psycho-environmental and genetic determinants of PA in a convenience sample of Spanish children and adolescents. Baseline data collection was conducted between 2011 and 2012 in a convenience sample of adolescents from the Madrid region (n=1037). All the studies were approved by the corresponding Ethics Committees[5,6,7]. Adolescents and their families or guardians were informed of the study characteristics and signed a written consent form.

PE enjoyment was assessed in the three studies with the same 7-point Likert scale with the following categories: 1. I don't have PE, 2. I don't attend PE, 3. I absolutely dislike PE, 4. I dislike PE, 5. I neither like nor dislike PE, 6. I like PE, and 7. I absolutely like PE. Adolescents who rated categories 1 and 2 were excluded for the analyses. Then, three groups were made: (i) don't like PE (categories 3 and 4), (ii) indifferent (category 5), and (iii) like PE (categories 6 and 7). A reliability analysis (1-week test-retest) of this question was performed in 64 participants from the UP&DOWN study who regularly engage in PE, obtaining a coefficient of intraclass correlation of 0.82.

Cognitive performance in the AVENA study was assessed using the Spanish version of the SRA Test of Educational Ability[8]. This questionnaire evaluates verbal (i.e. command of language, verbal identification, verbal reasoning, understanding of synonyms and vocabulary), numeric (i.e. speed and precision in performing operations with numbers and quantitative concepts), and reasoning (i.e. the ability to find logical ordination criteria in sets of numbers, figures, or letters) abilities. Direct scores ranging from 0 to 33 are obtained for each of these specific cognitive abilities.

In the AFINOS and UP&DOWN studies, academic performance was assessed through school grades. Participants from the AFINOS study self-reported their grades in the last semester, whereas in the UP&DOWN study grades were assessed through school records at the end of the academic year. Three indicators were used to define academic performance: individual grades for the core subjects (i.e. Mathematics and Language) and the average of both subjects. For statistical analyses, individual letter grades were converted to numeric data: A = 5, B = 4, C = 3, D = 2, F = 1.

Statistical analyses were carried out using the SPSS program for Windows, v.21.0. The significance level was set at P<0.05 for all analyses. All the variables are presented as mean (SD) or percentages. Differences between sexes were examined by one-way analysis of variance and Chi-squared test for continuous and categorical variables, respectively. Initially, differences in cognitive performance levels across the three groups of PE enjoyment (don't like PE classes, indifferent and like PE classes) were analyzed by analysis of covariance controlling for age and type of school (private, public). Bonferroni corrections were performed for pair-wise comparisons. Also, group-wise differences in cognitive and academic performance between those who do not like PE vs. another options (i.e. indifferent and like PE classes), as well as between those who like PE and other options (i.e. indifferent and don't like PE) were performed with analysis of covariance, after controlling for potential covariates.

Results

A total of 4226 adolescents from the AVENA (n=1627; 52.6% girls), AFINOS (n=1667; 52.7% gir-

ls) and UP&DOWN (*n*=932; 49.5% girls) studies had valid data for all the studied variables. The descriptive characteristics of the study sample, including a comparison between boys and girls, are shown in table I. In the AVENA study boys had higher scores than girls in verbal (*P*=0.005) and numeric (*P*<0.001) abilities, whe-

Table I
Characteristics of the study sample

	All	*Boys*	*Girls*	*P*
AVENA study (2000-2002)				
n	1627	771	856	
Age (years)	15.0±1.2	15.0±1.2	15.1±1.3	0.226
Private school (%)	7.3	10.3	4.6	**<0.001**
Cognitive Performance				
Verbal ability (0-33)	20.3±5.9	20.7±5.9	19.9±5.8	**0.005**
Numeric ability (0-33)	13.7±4.9	14.8±5.1	12.7±4.6	**<0.001**
Reasoning ability (0-33)	17.9±5.7	17.2±6.0	18.6±5.4	**<0.001**
Physical education enjoyment				
Don't like physical education (%)	9.0	8.4	9.5	
Indifferent (%)	38.0	35.1	40.7	
Like physical education (%)	53.0	56.4	49.9	**0.030**
AFINOS study (2007-2008)				
n	1667	789	878	
Age (years)	14.8±1.3	14.8±1.3	14.9±1.3	0.237
Private school (%)	14.7	14.4	14.9	0.786
Academic Performance				
Language (1-5)	2.9±1.3	2.8±1.3	3.1±1.3	**<0.001**
Mathematics (1-5)	2.8±1.4	2.9±1.3	2.8±1.4	**0.040**
Language and Mathematics (1-5)	2.9±1.2	2.8±1.2	2.9±1.2	0.191
Physical education enjoyment				
Don't like physical education (%)	8.2	7.7	8.7	
Indifferent (%)	37.7	31.7	43.2	
Like physical education (%)	54.1	60.2	48.2	**<0.001**
UP&DOWN study (2011-2012)				
n	932	471	461	
Age (years)	13.5±1.6	13.5±1.6	13.6±1.6	0.249
Private school (%)	16.1	18	14.1	0.101
Academic Performance				
Language (1-5)	3.0±1.3	2.8±1.4	3.2±1.3	**<0.001**
Mathematics (1-5)	2.9±1.3	2.8±1.3	2.9±1.4	0.817
Language and Mathematics (1-5)	2.9±1.2	2.8±1.3	3.0±1.2	**0.009**
Physical education enjoyment				
Don't like physical education (%)	7.3	8.5	6.1	
Indifferent (%)	31.2	26.1	36.4	
Like physical education (%)	61.5	65.4	57.5	**0.002**

Values are mean±SD or percentages

Table II
Levels of academic and cognitive performance according to physical education (PE) enjoyment in adolescents, by sex

	PE enjoyment			P_{value}	*Pair-wise comparisons*			*Group-wise comparisons*	
	Don't like PE (1) Mean±SD	*Indifferent (2) Mean±SD*	*Like PE (3) Mean±SD*		*1 vs. 2*	*2 vs. 3*	*1 vs. 3*	*1 vs. 2+3*	*1+2 vs. 3*
AVENA study (2000-2002)									
Boys, n	65	270	434						
Verbal ability (0-33)	21.4±5.4	20.5±6.0	20.8±5.9	0.352	0.488	1.000	0.512	0.150	0.711
Numeric ability (0-33)	14.8±4.5	14.6±5.2	14.9±5.2	0.947	1.000	1.000	1.000	0.896	0.810
Reasoning ability (0-33)	17.4±6.1	17.4±5.9	17.0±6.1	0.407	1.000	0.670	1.000	0.576	0.182
Girls, n	81	348	425						
Verbal ability (0-33)	21.0±6.0	19.9±5.5	19.7±6.0	0.082	0.210	1.000	0.077	**0.033**	0.191
Numeric ability (0-33)	13.0±4.0	12.4±4.4	12.9±4.8	0.295	0.682	0.553	1.000	0.409	0.321
Reasoning ability (0-33)	19.2±5.0	18.6±5.2	18.4±5.6	0.477	0.920	1.000	0.672	0.238	0.509
AFINOS study (2007-2008)									
Boys, n	61	250	478						
Language (1-5)	3.1±1.4	2.8±1.3	2.8±1.2	0.075	0.133	1.000	0.070	**0.024**	0.291
Mathematics (1-5)	3.0±1.4	2.9±1.4	2.9±1.3	0.554	1.000	1.000	0.975	0.383	0.360
Language and Mathematics (1-5)	3.0±1.3	2.9±1.2	2.8±1.1	0.178	0.420	1.000	0.193	0.075	0.260
Girls, n	76	379	423						
Language (1-5)	3.2±1.3	3.1±1.3	3.0±1.3	0.418	1.000	1.000	0.587	0.241	0.355
Mathematics (1-5)	2.9±1.4	2.8±1.4	2.8±1.4	0.652	1.000	1.000	1.000	0.390	0.563
Language and Mathematics (1-5)	3.1±1.3	2.9±1.2	2.9±1.2	0.462	1.000	1.000	0.661	0.260	0.405
UP&DOWN study (2011-2012)									
Boys, n	40	123	308						
Language (1-5)	3.0±1.3	3.0±1.4	2.6±1.4	**0.010**	1.000	**0.010**	0.600	0.444	**0.003**
Mathematics (1-5)	3.1±1.4	3.1±1.3	2.7±1.3	**0.010**	1.000	**0.011**	0.481	0.372	**0.003**
Language and Mathematics (1-5)	3.0±1.3	3.1±1.3	2.7±1.2	**0.005**	1.000	**0.005**	0.444	0.372	**0.001**
Girls, n	28	168	265						
Language (1-5)	3.9±0.8	3.1±1.3	3.1±1.3	**0.006**	**0.012**	1.000	**0.004**	**0.002**	0.165
Mathematics (1-5)	3.1±1.4	2.8±1.4	2.8±1.3	0.237	0.402	1.000	0.269	0.096	0.426
Language and Mathematics (1-5)	3.5±0.9	3.0±1.2	3.0±1.2	**0.026**	**0.047**	1.000	**0.021**	**0.008**	0.228

Analyses were adjusted for age and type of school (private, public).

reas girls had higher scores in reasoning ability than boys (P<0.001). In the AFINOS study, girls had higher scores in Language (P<0.001), meanwhile boys had higher scores than girls in Mathematics (P=0.040). In the UP&DOWN study, girls had higher scores than boys in Language (P<0.001) and in the average of Language and Mathematics (P=0.009). The percentage of adolescents who disliked PE was between 7% and 9% in the 3 studies. In all the studies, a higher percentage of adolescent boys than girls liked PE classes (56.4% *vs*. 49.9%, 60.2% vs. 48.2%, and 65.4% vs. 57.5% for the AVENA, AFINOS and UP&DOWN studies, respectively).

Levels of academic and cognitive performance according to PE enjoyment in adolescents from the three studies are shown in table II. In the AVENA study we only found differences in verbal ability among girls who dislike PE and their peers (P=0.033). In the AFINOS study, only boys who dislike PE had higher scores in Language than their peers (P=0.024). Finally, in the UP&DOWN study we found significant differences in all the academic variables in boys (all P≤0.01). However, significant differences were found between those who liked PE and their peers (all P<0.005), especially with the indifferent group (all P<0.02). Girls who disliked PE had higher scores in Language and in the average of Language and Mathematics than their peers (both P<0.01), in particular with those who liked PE (both P<0.03).

Discussion

The results of the present study in three relatively large and non-contemporary samples of Spanish adolescents show that (i) in the AVENA and AFINOS studies adolescents who disliked PE had similar results in cognitive and academic performance than their peers, but (ii) in the most recent study (the UP&DOWN study), girls who disliked PE showed higher results in academic performance than their peers, findings that were not observed in boys.

Adolescents who get better results than their peers in academic and cognitive performance exhibit a great capability in intellectual areas. They like to get the best results in everything they do and this kind of student is agreeable, conscientious and open[9,10]. They are very organized and focused on their studies, and develop a huge capability to relate the new knowledge with the old ones and to self-regulate their learning[11]. Hence, the myth herein examined is based on the idea that this kind of adolescents may desire those activities related with their cognitive and intellectual development than others where their bodies are mainly involved. Then, they may like more instrumental and well-considered subjects, such as language, mathematics and sciences, than PE. This fact could be based on the poor social recognition of PE, which it is thought it is not useful for life and considered a "physical" subject where the brain is not involved.

However, our results do not confirm this hypothesis. It seems that the myth is not true in boys, and in girls only in the last study. Since our non-null results are limited to girls in the most contemporary study, it indicates a potential gender- and time-specific effect in our findings. Further research on this issue could provide new evidence on this effect. The reason for these results could be because PE is as important as the other subjects for calculating the grade point average and students with great results do not want to reduce their average. Also, adolescents may know that PA is very important for their health and they could think it is necessary to use this PA time at school. Also, the differences between AVENA and AFINOS results and UP&DOWN results may be due to a potential age effect. AVENA and AFINOS adolescents are older (>1 year) than UP&DOWN adolescents. The results obtained could be because adolescents' choices about PE enjoyment changes depending on their age.

Regarding the levels of PE enjoyment, our results match with those obtained in other studies[4,12,13], showing that there was a greater proportion of adolescents who liked PE (>50%) than adolescents who disliked it (<10%). For example, two studies in Spanish and one in Canadian adolescents found similar levels of PE enjoyment[12,13,14]. Another study in a sample of American 12-year-old girls found even a higher proportion of adolescents who likes PE (i.e. 77%)[4]. In addition, our study suggests that the percentage of adolescents who like PE had increased through the years. This fact is important because, on the one hand, a higher percentage of adolescents could benefit from essential learning to be active during PE classes and outside school, and on the other hand, the potential target population of adolescents would be small.

The main weakness of the present study is its cross-sectional design, which limits the possibility to draw conclusions on the causality of the observed findings. Longitudinal studies are needed to elucidate the findings found herein. Several strengths of this study include, for example, the relatively large sample of adolescents in each study, the inclusion of three non-contemporary adolescents' samples, as well as assessing academic performance with different methods.

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