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ORIGINAL RESEARCH

Effect of curriculum-based physical education program on perceived motor competence and out-of-school healthy behaviors in adolescents with attention-deficit/hyperactivity disorder and typically developing adolescents

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Abstract

Background: The high presence of adolescent schoolchildren with attention-deficit/hyperactivity disorder (ADHD) is increasingly evident in physical education (PE) classes. **Objective:** The aim of this study was to analyze the effect of a 12-week curriculum-based PE program on perceived motor competence, and out-of-school healthy behaviors in a group of 13 adolescent schoolchildren with ADHD (9 boys and 4 girls, 15 years old), compared to a group of 13 typically developing schoolchildren of the same age (9 boys and 4 girls, 15 years old). **Methods:** The Spanish version of eight items to assess perceived motor competence from the Achievement Motivation for Learning in Physical Education Test, and the Spanish version of the Health Behavior in Schoolchildren Inventory were applied. The 12-week curriculum-based PE lessons, consisted of different curricular contents based on Decree 48/2015 from the Community of Madrid (Spain) such as fitness, athletics, basketball, foot orienteering, badminton, and gymnastics. All the instruments were applied before and after the 12-week PE lessons, to both groups of adolescent schoolchildren. **Results:** The results showed that the adolescent schoolchildren with ADHD, before and after the PE program, obtained significantly lower values than their typically developing peers, in perceived motor competence, and out-of-school healthy behaviors. However, after 12 weeks of PE lessons, there was only a significant increase in perceived motor competence among typically developing children, and there was no significant difference in both groups, for out-of-school healthy behaviors. **Conclusions:** At the end of this study, it can be concluded that the effect of curriculum-based PE program was not significant in children with ADHD on their perceived motor competence and out-of-school healthy behavior either.

Keywords: attention, physical education, motor competence, healthy habits

Introduction

During physical education (PE) lessons, children with low motor competence have problems when they have to run, catch, or dodge in games and sports, where they show an awkward style (Ruiz, 2021; Ruiz & Villa-de Gregorio, 2023). Different studies have shown that children with this condition have lower levels of participation in physical activities than their peers without this problem and are less likely to engage in both structured and unstructured physical activity and sports games when compared to typically developing children (Britton et al., 2020; Jaakola et al., 2019; Schmutz et al., 2020). These children are less active and fit when compared to their classmates (Morrison et al., 2018).

When schoolchildren see that they are able to carry out the tasks in a PE class, their sense of competence and confidence in their own resources increases. Feeling competent is a very important aspect that influences their desire to participate in sports activities in and out of school (Li et al., 2021; Ruiz-Pérez et al., 2015). With the development of self-awareness, perceived motor competence starts to reflect actual motor competence more accurately (den Uil et al., 2023) and this starts to influence physical activity levels in the school and out of the school. The ongoing development of physical activity and motor skills is thus influenced by perceived motor competence (Ruiz-Pérez et al., 2015). As a consequence, the spiral of disengagement in physical activity begins in children with low motor competence.

On the other hand, it is well-known that schoolchildren with attention-deficit/hyperactivity disorder (ADHD) have several problems with motor competence (Villa-de Gregorio et al., 2019, 2022). Adolescent schoolchildren with ADHD tend to be reluctant to participate in physical activities, games, and sports, both in PE classes and outside of them (Ruiz, 2021; Villa-de Gregorio et al., 2022). Thus, they could manifest a poor perception of their motor skills and their conditional and/or physical potential (Gallego-Méndez et al., 2021). Likewise, adolescent schoolchildren with ADHD are often called out for their "bad" behavior,

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during PE classes and/or in other physical-sports activities (in the street or extracurricular activities) by their teachers, peers, or relatives. This translates into a feeling of low self-esteem, which may result in physical-sports activities being very unpleasant for them (Kim & Ahn, 2021).

Moreover, it has been consistently identified that parents play a fundamental role in the attitude of their children with ADHD towards the practice of physical-sport activity (Hartley et al., 2016; Quintero-Olivas et al., 2021). Likewise, unstructured and/or spontaneous sports activities, which are usually proposed by siblings or classmates, could be effective facilitators to encourage the practice of physical-sports activities among adolescent schoolchildren with ADHD (Rowland et al., 2018).

Although the scientific literature delves into the complex network of physical, emotional, affective, and social difficulties that adolescent schoolchildren with ADHD usually face in physical-sports contexts, it is true that these variables are not analyzed taking into account the repercussions they may have on their healthy behaviors. Thus, in an effort to analyze the healthy behavior habits of Spanish adolescent schoolchildren, Castillo et al. (1997) adapted the World's Healthy Behavior in Schoolchildren Inventory (HBSC) to the Spanish population, resulting in a reduced version of it. This Inventory, sought to predict healthy behavior habits based on the practice of physical activity is defined by the following factors: 1. Personal factors (self-perception of motor competence, perceived health and physical fitness); 2. Social factors (parents', siblings', and/or friends' practice of physical activity, ability to make friends inside and outside of school, time spent with friends outside of school); 3. Environmental factors (access to sports facilities and belonging to a sports club).

Finally, the objective of this study was to evaluate the effect that a 12-week PE program at school can have on the perceived motor competence, and out-of-school healthy behavior habits of a group of adolescent schoolchildren, with and without ADHD.

Methods

Participants

The sample consisted of a total of 18 boys and 8 girls, aged between 15 and 16 years. Two groups were established: the first one housed schoolchildren diagnosed with ADHD (n = 13), while the second group was formed by typically developing (TD) schoolchildren of the same age (n = 13). All the participants belonged to the same public high school, located in the Community of Madrid. Likewise, it should be noted that the official diagnoses of the participants with ADHD were issued by the Public Services of the Health Department of the Community of Madrid and by the Guidance Department of the public high school in which the present study took place.

The inclusion criteria that were followed are described below: for the diagnosis of schoolchildren with ADHD, the criteria were followed, which appear in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM–5; American Psychiatric Association, 2013), as well as the official information contained in the medical and psychopedagogical reports; Those schoolchildren who presented some type of mental disorder, such as cerebral palsy, or intellectual disability, were excluded; Schoolchildren with ADHD were included in the present study, regardless of their pharmacological treatments. Regarding the inclusion criteria for typically developing participants, it should be noted that they had to be the same age as their peers with ADHD, and none of them should be under any medical treatment that cured possible disorders that could interfere with their learning process.

This study respected the postulates established by the Declaration of Helsinki and the ethical standards suggested for sports science research (Harriss & Atkinson, 2013). Furthermore, the schoolchildren and their parents and/or legal tutors signed an informed consent, in which they were informed of the objective of this study and the voluntary nature of the participation and abandonment of their children during the development, if necessary. Likewise, all procedures have been approved by the Ethics Committee of The Faculty of Physical Activity and Sport Sciences (Universidad Politécnica de Madrid, Spain).

Instruments

Perceived motor competence

For this study, eight items from the Spanish version of the Achievement Motivation for Learning in Physical Education Test (AMPETe-4; Ruiz-Pérez et al., 2015) were used. The items measure the student's perception of his or her ability to master the exercises regardless of how the rest of the class does, for example: "I have always considered myself to be one of the best in Physical Education class"; "I have always considered myself a person capable of performing well in any exercise in Physical Education classes"; "I always have the feeling that I am gifted in PE lessons"; "So far, I am good at PE without really trying hard to be good at it"; "I have always learned the exercises in PE very quickly"; "I like PE because I see myself capable of doing any task that is set there"; "I think I have the necessary qualities to be able to do the exercises in PE class"; "Since I was a child, I have been able to do the exercises well in Physical Education classes". Each item was presented with five points. The Likert scale ranges from 1 as *totally disagree* to 5 as *totally agree*.

The homogeneity indices of the items (corrected item factor correlation) were higher than .30. Likewise, with an alpha coefficient of .82, reliability was satisfactory (Ruiz-Pérez et al., 2015)

The structure was satisfactorily confirmed by confirmatory factor analysis showing a good internal consistency of the dimension of perceived motor competence according to the generally recommended values with goodness of fit > .90 and root mean square error of approximation < .08 (Ruiz-Pérez et al., 2015).

Out-of-school healthy behaviors

The Spanish version of the HBSC (Castillo et al., 1997) was applied. This instrument consists of 11 items that evaluate the following dimensions: 1. Personal variables: frequency of physical activity practice, with the answer

options being *never, less than once a week, every week, every day* (question 1 of the questionnaire); frequency of intense exercise, with the answer options being *never, less than once a week, once a month, once a week, 2–3 times a week, 4–6 times a week, everyday* (question 2 of the questionnaire); intention to be active in the future, being able to answer *definitely no, probably no, probably yes, definitely yes* (question 3 of the questionnaire); self-perception of their sport competence, with the answer options being *below average, medium, good, among the best* (question 4 of the questionnaire); self-perception of their perceived fitness shape, being able to answer *regular, normal, good, very good* (question 5 of the questionnaire); and perceived state of health, with the response options being *not very healthy, fairly healthy, or very healthy* (question 6 of the questionnaire); 2. Social variables: leisure time spent with friends, having as possible answers *I do not have friends at the moment, once a week or less, 2–3 days a week, 4–5 days a week* (question 7 of the questionnaire); ability to make friends within the school, with the response options being *always difficult, generally difficult, generally easy, always easy* (question 8 of the questionnaire); and ability to make friends outside the educational center, being able to answer *always difficult, generally difficult, generally easy, always easy* (question 9 of the questionnaire); 3. Environmental variables: sports practice of the significant other being the answer options *I do not have that person, I don't know, never, less than once a week, every week* (question 10 of the questionnaire); and belonging to a sports club, with the response options being *no, yes, but I do not participate, yes, I am training in a sports team* (question 11 of the questionnaire).

The reliability and validity levels of the questionnaire were satisfactory for the research. In addition, the Spanish version used shows an appropriate reliability (Cronbach's alpha = .965) factorial structure (> .91; Bravo & Potvin, 1991).

PE Program

The PE program that the participants in the study received was the one that is usually developed for students in the third school year of Secondary School in the Community of Madrid; therefore, it was not altered by the researchers, since one of the main purposes was to evaluate the effect that a curricular program, usually established for the PE subject, could have on the motor competence, motor competence perceived, and out-of-school healthy behaviors of adolescent schoolchildren. PE classes were typified by the development of different tasks of a perceptual-motor nature, physical conditioning and health, and personal and social development, which will be detailed throughout this manuscript. However, the set of tasks developed during PE classes, respected the Decree 48/2015, in which the PE curriculum in Compulsory Secondary Education in the Community of Madrid is established.

The PE teacher, responsible for the development of each of the lessons that took place throughout the 12-week program, showed a flexible methodological approach, through the implementation of a combination of teaching methods, teaching, and pedagogical models, all depending on the nature of the proposed tasks. Thus, the teacher fostered social relationships, participation, and the cognitive involvement of schoolchildren in the tasks developed during PE classes. In addition, he promoted the formation of heterogeneous groups in which any type of inequality for reasons of gender, social stereotypes, and/or differences in terms of motor skills were eliminated. Table 1 shows the curricular contents developed through the different teaching units, based on the methodological references previously described.

During PE classes, the participants developed a total of 1320 minutes of practice, divided into two weekly PE sessions of 55 minutes each for 12 consecutive weeks. A pretest was carried out before starting the 12-week PE program, and a posttest at the end of the program. During the first month (January) the fitness and athletics contents were developed; basketball and orienteering were developed during February. Finally, badminton and gymnastics were taught in March 2019.

Procedure

The main researcher of this study was the PE teacher at the participating school. Once the purpose of the study was exposed to the Management Team of the school, the corresponding family permits were requested and, after their approval, the instruments were applied to the participating adolescent schoolchildren. Adolescent schoolchildren, outside of school hours of PE classes, were evaluated in a conventional classroom, and the sports facilities before (pretest) and after (posttest) the 12-week duration of the study. Likewise, the participating adolescent schoolchildren were duly informed about the main considerations of the questionnaire (HBSC) and the items from the AMPETe-4 test (motor competence perceived items), and they were asked to be honest in their answers, reminding them that their participation in the study was voluntary, and they could abandon it if they considered it.

Table 1 Curricular contents

Content/Teaching unit	Pedagogical model	Motor task example
Fitness/Athletics	Physical education for health/motor literacy	Fitness circuits for couples and/or trios. Learning the technical models of jumps and throws.
Basketball	Teaching game for understanding	Game of the 10 passes; 3×3 (one basket); 4×4 (one basket)
Orienteering	Model hybridization: Cooperative learning and personal and social responsibility	Searching for markers by interpreting a map of the high school (groups of 5 students)
Badminton	Sport education	Badminton tournament
Gymnastics	Model hybridization: Cooperative learning, motor literacy, attitudinal style	Design and representation of a choreography (in groups of 8), which includes different gymnastic elements

Data analysis

Normal distributions were verified with the Shapiro-Wilk test. The normality requirement was not met. Therefore, a non-parametric statistical analysis was carried out. Mann-Whitney *U* test was used for between-group comparison, and Wilcoxon test for within-group comparison (pretest and posttest).

Effect size was calculated as $r = \sqrt{Z/N}$, where Z is the calculated value for the Mann-Whitney *U* test or Wilcoxon test and N number of samples (Morse, 1999). Their interpretation was based on the following criteria: $.1 \leq r < .3$ small effect, $.3 \leq r < .5$ medium effect, $.5 \leq r$ large effect (Cohen, 1988). The statistical software package IBM SPSS Statistics (Version 21; IBM, Armonk, NY, USA) was used. To analyze the data, the level of statistical significance was set at .05, and to control the Type I error, the level of significance was divided by the number of comparisons, so a result was considered significant if $p < .017$.

Results

Perceived motor competence

Table 2 presents the descriptive analysis of the study participants in the dimension of perceived motor competence from the Spanish version of the AMPETe-4 test for the two moments evaluated (pretest and posttest).

The ADHD group, compared to the TD group (both pretest and posttest), showed lower perceived motor competence ($Z = 3.21$, $p < .001$, $r = .77$ for pretest; $Z = 4.38$, $p < .001$, $r = .77$ for posttest).

Only, in the TD group, there was a significant increase in their perceived motor competence in the posttest compared to the pretest ($Z = 0.01$, $p = .500$ for the ADHD group; $Z = 2.51$, $p = .006$, $r = .24$ for the TD group).

Out-of-school healthy habits

Table 2 also presents the descriptive analysis of the study participants in the different dimensions of the Spanish version of the HBSC for the two moments evaluated (pretest and posttest).

As can be seen, both in the pretest and posttest, the group with ADHD compared to the TD group, showed a lower score in the personal variables ($Z = 4.24$, $p < .001$, $r = .72$ for pretest; $Z = 4.38$, $p < .001$, $r = .77$ for posttest) and in the social variables ($Z = 3.13$, $p = .001$, $r = .39$ for pretest; $Z = 3.98$, $p < .001$, $r = .63$ for posttest).

Another important aspect was finding that the scores did not change over time in any of the groups, nor in the personal variables ($Z = 0.14$, $p = .446$ for the ADHD group; $Z = 1.73$, $p = .042$ for the TD group) nor in the social variables ($Z = 1.73$, $p = .042$ for the ADHD group; $Z = 0.45$, $p = .323$ for the TD group).

Since no differences were observed in the TD group in the pretest, and none of the groups in the posttest, the appropriate comparisons were not made for the environmental variables.

Table 2 Means and standard deviations for the perceived motor competence and healthy behavior in pretest and posttest

	Pretest		Posttest	
Parameter	ADHD	TD	ADHD	TD
PMC	1.96 ± 0.45*	3.56 ± 0.11†	2.11 ± 0.28*	3.68 ± 0.12
PPVV	1.79 ± 0.55*	3.40 ± 0.11	1.79 ± 0.35*	3.49 ± 0.14
SSVV	2.44 ± 0.46*	3.02 ± 0.26	2.33 ± 0.40*	3.04 ± 0.17
EEVV	1.15 ± 0.55	3.00 ± 0.00	1.00 ± 0.00	3.00 ± 0.00

Note. ADHD = group with attention deficit/hyperactivity disorder; TD = typically developing group; PMC = perceived motor competence; PPVV = personal variables; SSVV = social variables; EEVV = environmental variables.*significant difference between the groups. †significant difference within the group between pretest and posttest.

Discussion

The main objective of this study was to verify if a school PE program had an effect on perceived motor competence and the out-of-school healthy behavior habits of a group of adolescent schoolchildren with and without ADHD. As a result of the application of nine items from the Spanish version of the AMPETe-4 test to assess the perceived motor competence and the Spanish version of the HBSC (Castillo et al., 1997), it can be stated that both before and after having performed the 12-week curriculum-based PE program, the participants with ADHD, compared with their typically developing peers, showed lower values in perceived motor competence. Likewise, the participants with ADHD also showed lower values in the personal, social, and environmental variables.

Moreover, after 12-week curriculum-based PE program the typically developing participants showed improvement in perceived motor competence. However, the PE program had no effect on the perceived motor competence of participants with ADHD.

Regarding schoolchildren with ADHD, the scientific literature has highlighted a series of psychosocial characteristics that usually manifest during PE classes, and that could justify the reason for the results obtained in this study, in relation to the personal variables in this group.

Cairney (2018), for example, highlighted that adolescent schoolchildren with ADHD usually consider themselves less competent in PE classes than the rest of their classmates, which leads them to show greater dread and fear of being wrong in class in front of their peers. Likewise, perceived motor competence is the best predictor of adolescents' practice of sports activities in and out of the school context (Barnett et al., 2009). Knowing how they perceive themselves and how they see themselves in comparison to their classmates would classmates, would allow the teacher to understand better their motivations for learning since low perceptions of competence indicate low motivation, low engagement, and the possibility of generating hopelessness toward participation in sports, games, and physical activities (Barnett et al., 2009; Duncan et al., 2018).

This framework of perceptions, in relation to the greater or lower competence of the adolescent student with ADHD ("compared to other boys/girls your age, how good do you consider yourself in sports?") could be perfectly extrapolated to other contexts outside of the PE classroom. Therefore,

it would be reasonable to think that, given the bad experiences of these adolescent schoolchildren with ADHD in PE classes, they would not want to participate in physical activities, sports, and games of an extracurricular nature.

Likewise, another reason that could dispel adolescent schoolchildren with ADHD from practicing and participating in physical and sports activities on a daily basis could be related to the lack of persistence, sacrifice, and daily work that usually characterizes them, when the task they must attend to does not bring them pleasure and, therefore, it is unlikely that what they are not capable of doing does not interest them (Villa-de Gregorio et al., 2022).

On the other hand, regarding the items that within the personal variables refer to how active and healthy they consider themselves ("How do you consider your fitness shape?"; "How healthy do you think you are?"), the results that the present study brings could situate the group of adolescent schoolchildren with ADHD as less active than their typically developing peers, which coincides with what numerous studies have shown, when characterizing adolescent schoolchildren with ADHD as schoolchildren who do not accumulate a high practice deficit in moderate and vigorous sports activities, which is not positive for their future health (Chan et al., 2022; Hoza et al., 2020; Suárez-Manzano et al., 2022; Wymbs et al., 2021). Therefore, schoolchildren with ADHD in the present study stated that they practiced vigorous physical activity less frequently than typically developing schoolchildren ("Outside of school, how many times a week do you usually exercise in your free time, in such a way that you sweat or get exhausted (almost out of breath)?").

It makes sense to think that these adolescent schoolchildren do not have great confidence in improving their motor skills in the future, and they do not see themselves practicing sports when they get older ("Do you think that when you are 20 years old you will practice sports or take part in physical activities?"). Perceiving themselves as capable in sports, perceiving that they have the necessary resources, in addition to feeling healthy, are aspects that will help change this way of thinking since adolescent schoolchildren could become more active in the future (Ruiz, 2021).

Regarding the social variables analyzed, it is worth noting the large differences observed between the two groups of adolescent schoolchildren evaluated (ADHD and TD) at both moments of the evaluation (pretest and posttest).

Research has shown how adolescent schoolchildren with ADHD present more difficulties in socializing, interacting with their peers, and establishing new friendships (within and outside the school context) than their typically developing peers (Hai & Climie, 2022). This coincides with the responses of the ADHD group in the present study to the items that explored these social relationships ("How often do you spend your free time with friends after school?"; "Is it easy for you to make new friends at high school?"; "Is it easy for you to make new friends outside of high school?") who showed the difficulties described above. In addition, Villa-de Gregorio et al. (2022) found that adolescents with ADHD in PE classes prefer to work and practice individually. The difficulties in interacting with their peers could determine the type of practice and the frequency of it, both in and out of the school time.

Regarding the environmental variables analyzed, the results revealed the importance of the habit of practicing physical and sports activities within the family, since it has been possible to verify that in the group of adolescent schoolchildren with ADHD, did not exist the practice of regular physical-sports activities within the family, which could be used as a reference model ("Here is a list of people you know: father, mother, older brother, older sister, or your best friend, Do any of them play sports in their free time?"). In line with these results, some authors (Li & Shao, 2022; Ruiz-Pérez et al., 2015) stated that the family and their most significant others (siblings and friends) were very important environments for adolescent schoolchildren, strengthening good healthy lifestyle habits related to the regular practice of physical and sports activities. Similarly, Jia et al. (2021) placed most of the responsibility for promoting healthy habits of daily practice of physical activity, in parents and siblings.

Lastly, this study revealed that, among schoolchildren with ADHD, there is a low degree of affiliation ("Are you a member of a sports club?") compared to their peers without difficulties. It could be hypothesized that the personal, social, and environmental reasons discussed above cause little desire to belong to any club or sports group. In relation to these results, Villa-de Gregorio et al. (2022) observed that the individualistic practice preferences of these students in PE are quite stable, shying away from groups and group activities.

The main limitations of this study include its design because there was no other study group that received a different PE program than the one developed to rule out possible biases. In addition, with a non-random division of the groups was impossible to know if unknown or unmeasured factors that affect the outcomes of interest are evenly distributed across the intervention groups. Likewise, we could not evaluate the methodology developed during the 12 weeks of PE classes (teaching methods, teaching styles, teaching techniques, pedagogical models, etc.) that may have influenced the results obtained. For future studies, it is highly recommended to design interventions of longer duration.

Conclusions

This study found that adolescent schoolchildren with ADHD do not acquire healthy habits outside school because their perceived motor competence in PE classes is low. However, it might be concluded that the PE program contributed to the significant improvement of perceived motor competence among typically developing children. Therefore, having good experiences in PE could be a good predictor for the adoption of active lifestyles outside the classroom, whether or not one is a school child with ADHD.

Community-school based should be made aware of the importance of PE with particular attention paid to improving the quality of PE classes, attending to the current students' heterogeneity, and contributing to overall development of students with ADHD.

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Conflict of interest

The authors report no conflict of interest.

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