Effect of a physical activity program on fitness perception of 9 to 11-year-old schoolchildren

Efecto de un programa de actividad física sobre el fitness percibido en escolares de 9 a 11 años

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Abstract

The aim of the present study was to analyze the effect of a physical activity (PA) program on the fitness perceptions (FP) of nine-to-11-year-old schoolchildren. This quasi-experimental study involved 24 children divided into experimental (EG) and control groups (CG). Perceptions of fitness (FP), cardiorespiratory fitness (CRFP) and muscular strength (MSP) were assessed using the International Physical Fitness Scale (IFIS). Mann-Whitney and Wilcoxon U tests were used with significance set at $p < .05$. Significant differences were found between groups in *FP* (.000 $p < .05$), *CRFP* (.002 $p < .05$) and *MSP* (0.02 $p < .05$), with better perceptions existing in the EG. The estimated effect size was large, indicating real differences between the two groups (*FP [CG]* = 0.15; *FP [EG]* = 1.71; *CRFP [CG]* = 0.15; *CRFP [EG]* = 2.50; *MSP [CG]* = 1.14; *MSP [EG]* = 3 .34). The main findings revealed that the examined PA program had a significantly positive effect on FP both overall and in relation to its cardiorespiratory (CRF) and muscular strength (MS) components. A large effect size

Resumen

El objetivo fue analizar el efecto de un programa de actividad física (AF) sobre el fitness percibido (FP) de escolares de nueve a 11 años. Este estudio cuasi-experimental involucró a 24 niños divididos en grupo experimental (GE) y grupo control (GC). Los componentes FP, aptitud cardiorrespiratoria percibida (CRFP) y fuerza muscular percibida (MSP) se evaluaron con la Escala Internacional de Aptitud Física (IFIS). Se utilizaron las pruebas U de Mann-Whitney y Wilcoxon; significación $p < .05$. Se encontraron diferencias significativas entre grupos en *FP* (.000 $p < .05$), *CRFP* (.002 $p < .05$) y *MSP* (0.02 $p < .05$) a favor del GE. El tamaño del efecto estimado es grande para establecer diferencias entre grupos (*FP CG* = 0.15, *FP EG* = 1.71, *CRFP CG* = 0.15, *CRFP EG* = 2.50, *MSP CG* = 1.14, *MSP EG* = 3.34). Los principales hallazgos muestran que un programa de AF tiene un efecto significativamente positivo en la FP y en los componentes de aptitud cardiorrespiratoria (CRF) y fuerza muscular (MS) en comparación con el GC; también

was also produced with regards to differences between experimental and control groups. The strategy examined here could be applied in schools and may also influence psychological, academic and social outcomes.

Keywords: Self-perception, physical education, cardiorespiratory fitness perception, muscular strength perception, IFIS.

produce un gran tamaño del efecto sobre las diferencias entre grupos. Por lo tanto, es una estrategia que podría aplicarse en las escuelas y puede influir en otras áreas como la psicológica, académica y social.

Palabras claves: Autopercepción, educación física, fitness cardiorrespiratorio percibido, fuerza muscular percibida, IFIS.

Introduction

Available scientific evidence supporting the positive effects of physical activity (PA) has increased greatly in recent years (Reyes-Amigo & Soto-Sánchez, 2021; Tapia-Serrano et al., 2022), stoking the interest of researchers in the field of fitness (Baquet et al., 2010), given the impact that improved fitness has on health (Janssen & Leblanc, 2010). Further, PA also has a big impact on self-perceptions, which is an important psychosocial factor involved in the development of children and adolescents (Coelho et al., 2014). Self-perceptions are the perceptions that individuals have of themselves at any given moment (Ferrari et al., 2022). This indicator is relevant because it is positively associated with PA engagement (Baceviciene et al., 2019; Grao-Cruces et al., 2014; Videra-García & Reigal-Garrido, 2013), which, in turn, is also positively related to quality of life (Gálvez Casas et al., 2016). Indeed, the importance of participation in PA programs focused on improving physical fitness (PF) (Janz et al., 2002) lies in the fact that several studies have found a relationship between greater PF, self-concept and intention to continue being active (Guillamón et al., 2018). In this regard, it is necessary to implement programs that effectively target fitness perceptions (FP), not only fitness itself and its traditional physiological components (Dios et al., 2019; Reyes-Amigo et al., 2018; Salmon et al., 2007; Verstraete et al., 2006), which have been evaluated mainly through physical tests (Ruiz et al., 2011). Such approaches must be evaluated through subjective methods, such as the Screening for and Promotion of Health-Related Quality of Life in Children and Adolescents (KIDSCREEN) tool (Aymerich et al., 2005) and the International Fitness Scale (IFIS) (Ortega et al., 2011). The school context is of vital importance given that, in most countries around the world, children and adolescents attend school for a period of 10 to 12 years. In this sense, the importance of awakening and informing FP lies in the fact that poor FP have been found to predict the emergence of certain psychological problems, such as image anxiety, low self-esteem and dissatisfaction with life (Crocker et al., 2003; Crocker et al., 2007). Likewise, some studies (Ensrud-Skraastad & Haga, 2020) have reported a connection between body composition and FP, with schoolchildren with a higher body mass index (BMI) being more likely to present poor FP. In addition, the current issues of interest takes on further importance because it covers some of the variables that can impact personal well-being of children and adolescents (Kyle et al., 2016), whilst also influencing their social setting (Sanz et al., 2023). This makes it necessary to implement new strategies that promote fitness and FP. Such strategies include PA programs using games in physical education (PE) classes (Reyes-Amigo et al., 2018), modified sports and thematic games, all of which place an emphasis on fun and enjoyment. In this regard, the aim of the present study was to analyze the effect of a PA program on FP in nine-to-11-year-old students.

Method

This research is experimental in nature and followed a quasi-experimental design (Figure 1) with an experimental (EG) and non-equivalent control group (CG). A pretest-posttest design was applied to both groups. The study was carried out in a school located in La Calera, Valparaíso, Chile.

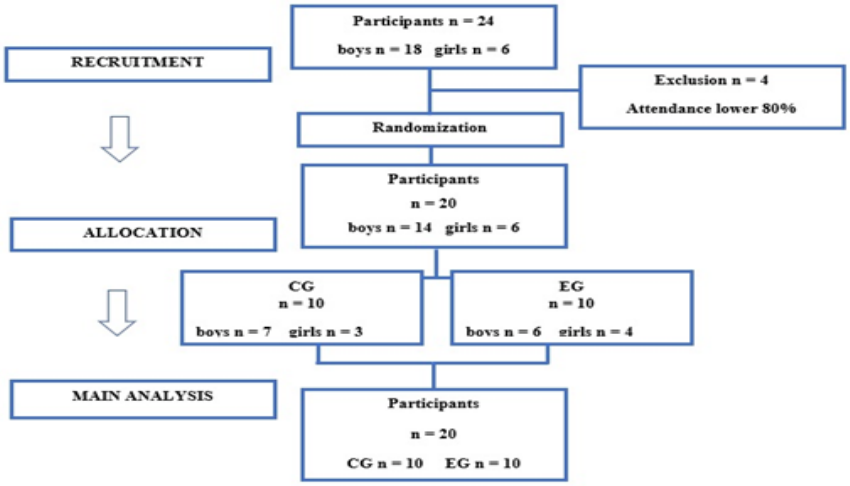

Figure 1. Study design

n: number of participants; CG: control group; EG: experimental group

Participants

The sample included 24 participants attending the 4th and 5th grade of elementary school. A total of 16 boys and eight girls participated with an average age of 10.45 ± .887 years. Sexual maturity according to Tanner ranged from one to two (Tanner & Whitehouse, 1976). Participants were selected according to intentional non-probability sampling (Thomas & Nelson, 2007). Participants were divided into an experimental group (EG) and a control group (CG) via simple randomization (Lim & In, 2019). Inclusion criteria stipulated that participants were to be in sufficient health to be able to engage in PA and regularly attend PE classes prior to the intervention. Participants were excluded if they had a lower than 80% attendance to PE classes where the intervention was applied, presented with an adverse reaction to the stimulus provided by the PA program, participated in PA programs outside of school hours, or tested positive for COVID-19. Four students were excluded for low attendance during the intervention leaving a final sample of 20 participants. Specifically, the CG included 10 participants (seven boys and three girls) and the EG comprised 10 participants (six boys and four girls). Both the CG and EG received classes twice a week on different days and times. The EG engaged in the intervention while the CG continued with their regular PE classes. The study was designed according to the international ethical regulations of the Declaration of Helsinki, 1975 (Manzini, 2000). Approval was received from the Scientific Ethics Committee of the Universidad de Playa Ancha, Chile (2019, 20-06-19). All study participants provided written consent from their parents or legal guardians and had authorization from their school.

Intervention

The intervention was carried out two times a week over a period of 12 weeks during timetabled physical education classes. Classes were divided into three parts. Each started with a five-minute warm-up with joint mobility and short distance speed exercises. This was followed by a 30-minute activity consisting of nine cardiorespiratory fitness (CRF) exercises, nine muscular strength (MS) exercises and eight Tabata exercises. All classes finished with a five-minute cool down (full details provided in Table 1).

The same learning objective was set for physical education classes in both the experimental group and the control group, however, the control group continued with their regular activities without receiving any specific intervention.

Table 1. Physical education class intervention, experimental group

Stages	Type exercise and times	Total Time	
		Execution	Recovery
Warm-up	Joint mobility and short-distance movements at different speeds V: use of balls.	5 min	
Development	CRF: 6 exercises / Int: 7-8-9 EPInfant scale Straight-line races: 2 sets x 15 s (30 s) x 15 s recovery (30 s) Zig-zag: 2 sets x 25 s (50 s) x 25 s recovery (50) Agility Ladder: 2 sets 60 s (120 s) x 55 s recovery (110 s) Straight line manipulation: 2 set x 25 s (50 s) x 25 s recovery (50 s) Straight line manipulation 3 objects: 2 sets x 65 s (130 s) x 55 s recovery (110 s) Manipulation ladder: 2 sets x 80 s (160 s) x 70 s recovery (140 s)	9 min	8 min 10 s
	MS: 9 exercises / Int: 7-8-9 EPInfant scale Upperbody: Isometric push ups: 2 sets 15 s (30 s) x 15 s recovery (30 s) Push ups: 2 sets 15 s (30 s) x 15 s recovery (30 s) Shoulder flexion: 2 sets 15 s (30 s) x 15 s recovery (30 s) Lowerbody: Hip abducction: 2 sets 15 s (30 s) x 15 s recovery (30 s) Jumps back and forth (forward and backward): 2 sets 15 s (30 s) x 15 s recovery (30 s) Squats: 2 sets 15 s (30 s) x 15 s recovery (30 s) Core: Hip rises: 2 sets 15 s (30 s) x 15 s recovery (30 s) Lying back extension: 2 sets 15 s (30 s) x 15 s recovery (30 s) Leg rises: 2 sets 15 s (30 s) x 15 s recovery (30 s)	4 min 30 s	4 min 30 s
	Tabata: 8 exercises / Int: 7-8-9 EPInfant scale Jumps back and forth (side to side): 20 s x 10 s recovery Four supports: 20 s x 10 s recovery Sit ups: 20 s x 10 s recovery Jumps back and forth (forward and backward): 20 s x 10 s recovery Four supports switching arms: 20 s x 10 s recovery Separated and join leg when elevated: 20 s x 10 s recovery Inverted table position: 20 s x 10 s recovery Vertical jumps with ball in hand: 20 s x 10 s recovery	2 min 40 s	1 min 20 s
Cool down	Feedback	5 min	

V= variations; CRF = cardiorespiratory fitness; Int = intensity; EPInfant = rating of perceived exertion scale; MS = muscular strength; min = minutes; s = seconds.

Sessions were administered by two physical education teachers. Teacher one introduced the objective of the session, executed all stages of the class, demonstrated all CRF and MS exercises and kept time. Teacher two arranged all elements of the session prior to its start, organized activities during the session and put everything away at the end, provided feedback on execution, measured perceived effort (PEInfant) and kept time.

The intensity of the execution of exercises was monitored via the self-report the PEInfant scale (Rodríguez-Núñez et al., 2019). For this, students were asked to rate how tired they were before, during and after exercise completion. Ratings were given on a visual scale that contained the numbers from zero to 10 alongside images depicting the concomitant level of fatigue.

A total of 13 mats, 13 rings, 13 canes, 13 balls, 13 elastic bands, 13 PEInfant scales (for measurement of perceived exertion), 78 pyramidal cones and an LG model FH2 speaker were used.

Instruments

The IFIS questionnaire was used to measure perceptions of fitness and of some of its components (Ortega et al., 2011). This is a self-report instrument, in which respondents provide their responses on a piece of paper. Students were requested to think, firstly, about their own fitness and, secondly, about their fitness in relation to their PE classmates. With this in mind, they were instructed to respond to each question with a rating that corresponded to very bad, bad, acceptable, good, or very good. The test was administered whilst respondents were seated with a single blank answer sheet on a table in front of them (Cárdenas, 2016). All responses were given individually. Two teachers were present throughout during the administration of questionnaires. Baseline and follow-up measurements were carried out with both groups on the same day. Maturity was evaluated by asking participants to rate their own pubertal stage in line with images of the Tanner stages. Classifications were then performed individually and independently in a specially-assigned room whilst a pediatrician monitored the process. All participants were able to allocate themselves to one of the five sex-specific stages described in reference to the Tanner scale (Tanner & Whitehouse, 1976).

Statistical Analysis

Once data collection was concluded, all response data were input into a statistical program to examine descriptive statistics. Next, the Shapiro Wilk test was performed to establish the data distribution. Later, the non-parametric Mann-Whitney U test was performed in order to establish group differences. Further, the Wilcoxon test was performed to examine whether significant differences existed between the groups. Significance was set at $p < .05$. All data analysis was performed using the statistical software Statistical Package for Social Sciences (SPSS) version 25. Effect sizes (ES) were calculated in accordance to Hedges' g, with .2 indicating a small effect, .5 indicating a medium effect and .8 indicating a large effect (Apaza et al., 2021).

Results

Next, the main results of the study are discussed. Sample characteristics are presented according to age, weight, and size in Table 2. It can be seen that, following the application of exclusion criteria, the sample was comprised of 20 participants, in which 13 were boys and seven were girls. Average age was 10.45 years old and average weight was 51.82 kilograms. Average height was 146 centimeters.

Table 2. Characterization of the sample related to age, weight, and size

Participants			Age	Weight	Size
n =Boys	*n* = Girls	Total *n*	Mean-SD	Mean-SD	Mean-SD
13	7	20	10.45 ± 8.87.	51.82 ± 16.972	146 ± .068.

n = number of participants; SD = standard deviation.

Next, Table three presents frequencies pertaining to baseline responses for FP, CRFP and MSP questions and relevant categories of the IFIS in both groups. As shown in Table three, with regards to baseline responses to IFIS categories and FP in the CG, two students reported perceiving that they had poor fitness, six reported acceptable fitness and two reported perceiving themselves to have good fitness. With regards to the CRFP, three respondents reported poor fitness, two reported acceptable fitness and five reported good fitness. With regards to MSP, three reported poor fitness and seven reported acceptable fitness. With regards to CG responses to the FP question following the intervention, outcomes revealed that one participant perceived themselves to have poor fitness, seven reported acceptable fitness and two reported good fitness. With regards to the CRFP, six participants reported acceptable fitness and four reported good fitness. In relation to the MSP, two respondents reported poor fitness, four reported acceptable fitness, three reported good fitness and one reported very good fitness. Turning attention to the EG, baseline responses to the FP question revealed that one participant perceived themselves to have very poor fitness, three reported poor fitness, five reported acceptable fitness and one reported good fitness. With regards to MSP responses, one participant perceived themselves to have very poor fitness,

five reported bad fitness and four reported acceptable fitness. Following the intervention, with regards to FP, seven EG participants perceived themselves to have good fitness and three participants perceived themselves to have very good fitness. With regards to CRFP, six participants perceived themselves to have acceptable fitness and four perceived themselves to have good fitness. Finally, with regards to MSP, three participants reported good fitness and seven reported very good fitness.

Table 3. Pre and post test of frequency responses for IFIS category of CG and EG in PF, CRF and MS

Category IFIS	Pre test CG			Post test CG			Pre test EG			Post test EG		
	PFP	CRFP	MSP	PFP	CRFP	MSP	PFP	CRFP	MSP	PFP	CRFP	MSP
Very bad								1	1			
Bad	2	3	3	1		2	2	3	5			
Acceptable	7	2	7	7	6	4	6	5	4		6	
Good	2	5		2	4	3	1	1		7	4	3
Very good						1				3		7

CG = control group, EG = experimental group; PFP = physical fitness perception, CRFP = cardiorespiratory fitness perception; MSP = muscular strength perception.

Table four presents median, standard deviation and p values produced from the analysis of independent samples and the comparative analysis conducted between groups of baseline and post-intervention PFP, CRFP, and MSP outcomes from the IFIS. Specifically, the Mann-Whitney U test for two independent samples was used.

In this regard, comparative analysis of the medians for the three variables studied at baseline (FP CG = 3; FP EG = 2.9; CRFP CG = 2.9; CRFP EG = 2.6; MSP CG = 2.7; MSP EG = 2.3) reveals no significant differences between the groups prior to the start of the intervention. Following the intervention, analysis of the medians for the three studied variables (FP CG = 3.1; FP EG = 4.3; CRFP CG = 3.4, CRFP EG = 4.4; MSP CG = 3.3; MSP EG = 4.7) reveals significant differences between the groups following the end of the intervention. At first, no significant differences were present between CG and EG in any of the three variables (FP: .721, $p < .05$; CRFP: .460, $p < .05$; MSP: .156, $p < 0.05$). However, following the intervention, significant differences were found between the two groups for all of the three measured variables (FP: .000, $p < .05$; CRFP: .002, $p < .05$; MSP: .002, $p < .05$). With regards to the magnitude of the effect of the intervention, Hedges g outcomes (FP CG = 0.15; FP EG = 1.71; CRFP CG = 0.15; CRFP EG = 2.50; MSP CG = 1.14; MSP EG = 3.34) indicate that the estimated effect size based on the observed differences between groups is large in connection to the examined variables.

Table 4. Analysis of independent samples, comparison of CG and EG in pre- and post-test in PFP, CRFP and MSP

Variables	CG				EG			
	Pre Median SD	Post Median SD	*p*-value	ES (*g*)	Pre Median SD	Post Median SD	*p*-value	ES (*g*)
PFP	3.0 ± .667	3.1 ± .568	.721.	0.15	2.9 ± .568	4.3 ± .483	.000*	1.71
CRFP	2.9 ± .738	3.4 ± .516	.460.	0.75	2.6 ± .843	4.4 ± .516	.002*	2.50
MSP	2.7 ± .483	3.3 ± 949	.156.	1.14	2.3 ± .675	4.7 ± .483	.002*	3.34

CG = control group; EG = experimental group; PFP = physical fitness perception, CRFP = cardiorespiratory fitness perception, MSP = muscular strength perception, SD = standard deviation, * = significance level $p < 0.05$, ES (g) = effect size.

Table five presents median values and comparative outcomes pertaining to inter-group comparisons and intra-group comparisons prior to and following the intervention in both study groups for the FP, CRFP and MSP variables of the IFIS.

With regards to outcomes of the intragroup comparison in CG (FP CG = .317; CRFP CG = .059; MSP CG = .034), no significant differences emerged within the CG once the intervention was completed. In relation to the intragroup comparison in GE (FP GE = .004; CRFP GE = .004; MSP GE = .004), outcomes reveal that significant differences exist between baseline and post-intervention scores.

Table 5. Analysis of samples related to pre- and post-test of intra group comparison of PF, CRF and MF

Variables	CG			EG		
	Pre Median	Post Median	*p* - value	Pre Median	Post Median	*p* - value
PFP	3.0	3.1	.317	2.9	4.3	.003*
CRFP	2.9	3.4	.059	2.6	4.4	.001*
MSP	2.7	3.3	.034	2.3	4.7	.002*

CG = control group; EG = experimental group; PFP = physical fitness, perception CRFP = cardiorespiratory fitness perception, MSP = muscular strength perception, * = significance level p < 0.05.

Discussion

The aim of the present study was to analyze the effect of a PA program on FP in schoolchildren. In this sense, the main findings revealed that a PA intervention based on intermittent aerobic activities, multi-jumps and weight-bearing activities carried out in PE classes over a period of 12 weeks with the aim of improving FP, CRFP and MSP in schoolchildren, produced significant differences. This was observed through the large effect size found for the differences between groups following intervention completion.

The main finding of the present study reiterates that previously reported Segovia and Gutiérrez (2020), in which students who participated in a PA program, in the form of PE classes, over a period of 5 weeks, in which specific exercises were incorporated to stimulate components of FP, obtained improvements in FP. This should be considered in light of findings presented by existing scientific literature regarding the benefits of appropriate FP and the effect of this on promoting improvements in fitness and at a psychological and social level (Palacios et al., 2022). This is particularly important at the critical stage under consideration in the present study (childhood and adolescence), given that many of the habits that will be engaged in throughout later life are established at this stage. In the same way, improved FP, alongside a better body image, may be important factors underlying student self-perceptions when they engage in PA. This can be hugely important during childhood and adolescence (Kyle et al., 2016). Indeed, outcomes do not only affect one aspect of students' lives but, also, can be transferred to other areas such as academic performance, sporting activities and social relationships. (Ruiz-Montero et al., 2020). In this way, FP can have a huge impact on the aforementioned areas, leading to the acquisition of different habits pertaining to an active lifestyle and the avoidance of certain harmful behaviors (Garrido et al., 2012). In the same way, Lizarazo et al (2020), previously discussed the relationship between physical activity and heightened self-esteem in children and adolescents. They argued that, during the school stage, children are involved in events with a high emotional load due to social issues, body changes, problems at home and bullying, amongst others. This causes stress, depression and low self-esteem. In this study, it was revealed that students who rarely or irregularly engage in physical activity are more likely to have low self-esteem, poor mental health and acquire unhealthy habits.

Consolidating the importance of obtained outcomes regarding FP, it is crucial to highlight the need to include strategies in the educational field that enable, through PA engagement, variables related to physical self-concept or FP to be properly and fully evaluated considering that they may be associated with better perceptions of the abilities needed to tackle academic tasks (Chaddock et al., 2011). Alongside this, physical activity programs are a strategy that target improvements in CF. This, not only positively affects physical health but, also, mental health. Further, the evaluation of such programs provides empirical evidence (Velez et al., 2010) that underlines the importance of CF in the analysis of self-concept. Further, physical exercise is considered to be a purposeful and intentional activity that positively affects self-perception in young people (Garn et al., 2019). In this way, it is clear that targeting these parameters is essential for motivating young people to engage in physical activity (Vedul-Kjelsås et al., 2012).

Limitations

Firstly, one of the limitations of the present study is the low number of participants involved in the PA program delivered during PE classes. This was due to the poor health conditions generated by the presence of COVID-19, which majorly affected the ability of students to attend classes. Secondly, only a very limited amount of literature examining the effect of PA school programs on PF could be identified and used to frame the discussion of present findings.

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Conclusions

The main finding of the present study is that the examined PA program had a significantly positive effect

on PF, CRFP and MSP. Hence, the program examined here offers a potential strategy to consider in the school context as a means to extending the reach of present findings to other ambits such as the psychological, academic and social ambits.

Bibliography

Apaza, J., Franco, J., Meza, N., Madrid, E., Loézar, C., & Garegnani, L. (2021). Minimal clinically important difference: The basics. *Medwave*, *21*(3). https://doi.org/10.5867/MEDWAVE.2021.03.8149

Aymerich, M., Berra, S., Guillamón, E., Herdman, M., Alonso, J., Ravens-Sieberer, U., & Rajmil, L. (2005). Desarrollo de la versión en español del KIDSCREEN, un cuestionario de calidad de vida para la población infantil y adolescente. *Gaceta Sanitaria*, *19*(2), 93–102. https://doi.org/10.1157/13074363

Baceviciene, M., Jankauskiene, R., & Emeljanovas, A. (2019). Self-perception of physical activity and fitness is related to lower psychosomatic health symptoms in adolescents with unhealthy lifestyles. *BMC Public Health*, *19*(1). https://doi.org/10.1186/s12889-019-7311-2

Baquet, G., Gamelin, F., Mucci, P., Thé, D., Van Praagh, E., & Berthoin, S. (2010). Continuous vs. interval aerobic training in 8-to 11-year-old children. *Journal of Strength and Conditioning Research*, *24*(5), 1381–1388. https://doi.org/10.1157/13074363

Cárdenas, E. (2016). *Auto-reporte de la Condición Física Relacionada con la Salud en una Muestra de Escolares del Distrito Bogotá: Estudio FUPRECOL*. [Tesis de maestría, Universidad del Rosario]. https://doi.org/10.48713/10336_12496

Chaddock, L., Pontifex, M., Hillman, C., & Kramer, A. (2011). A review of the relation of aerobic fitness and physical activity to brain structure and function in children. *Journal of the International Neuropsychological Society*, *17*(6), 975–985. https://doi.org/10.1017/S1355617711000567

Coelho, V., Sousa, V., & Figueira, A. P. (2014). O impacto de um programa escolar de Aprendizagem Socioemocional sobre o autoconceito de alunos de 3° ciclo. *Revista de Psicodidactica*, *19*(2), 347–366. https://doi.org/10.1387/RevPsicodidact.10714

Crocker, P., Sabiston, C., Forrestor, S., Kowalski, N., Kowalski, K., & Mcdonough, M. (2003). Predicting Change in Physical Activity, Dietary Restraint, and Physique Anxiety in Adolescent Girls. Examining Covariance in Physical Self-perceptions. *Canadian Journal of Public Health, 94*(5), 332-337. https://doi.org/10.1007/BF03403555

Crocker, P., Sabiston, C., Kowalski, K., McDonough, M., & Kowalski, N. (2007). Longitudinal Assessment of the Relationship Between Physical Self-Concept and Health-Related Behavior and Emotion in Adolescent Girls. *Journal of Applied Sport Psychology, 18*(3), 185-200. https://doi.org/10.1080/10413200600830257

Dios, A., Recuero, B., Calvo, A., & Shaoliang, Z. (2019). Effects of a school physical activity intervention in pre-adolescents. *Apunts. Educación Física y Deportes*, *136*, 49–61. https://doi.org/10.5672/APUNTS.2014-0983.ES.(2019/2).136.04

Ensrud-Skraastad, O., & Haga, M. (2020). Associations between Motor Competence, Physical Self-Perception and Autonomous Motivation for Physical Activity in Children. *Sports*, *8*(9). https://doi.org/10.3390/sports8090120

Ferrari, G., Bolados, C., Suárez-Reyes, M., Farías-Valenzuela, C., Drenowatz, C., Marques, A., & Pizarro, T. (2022). Association of physical activity, muscular strength, and obesity indicators with self-concept in Chilean children. *Nutrición Hospitalaria*, *39*(5), 1004–1011. https://doi.org/10.20960/nh.04061

Gálvez Casas, A., Rodríguez García, P., Rosa Guillamón, A., García-Cantó, E., Pérez Soto, J., Tárraga López, P., & Tárraga Marcos, L. (2016). Capacidad aeróbica, estado de peso y autoconcepto en escolares de primaria. *Clínica e Investigación en Arteriosclerosis*, *28*(1), 1–8. https://doi.org/10.1016/j.arteri.2015.10.002

Garn, A., Moore, E., Centeio, E., Kulik, N., Somers, C., & McCaughtry, N. (2019). Reciprocal effects model of Children's physical activity, physical self-concept, and enjoyment. *Psychology of Sport and Exercise*, *45*, 101568. https://doi.org/10.1016/j.psychsport.2019.101568

Garrido, R., Videra García, A., Luis, J., Flores, P., & Ruiz De Mier, R. (2012). Physical sports activity, physical self-concept and psychological wellbeing in adolescence. *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación*, *22*, 19–23. https://doi.org/10.47197/retos.v0i22.34578

Grao-Cruces, A., Fernández, A., Fernández-Martínez, F., Martínez, M., & Nuviala, A. (2014). Association of Fitness With Life Satisfaction, Health Risk Behaviors, and Adherence to the Mediterranean Diet in Spanish Adolescents. *The Journal of Strength and Conditioning Research, 28(8), 2164-2172.* https://doi.org/10.1519/JSC.0000000000000363

Guillamón, A., Canto, E., & Carrillo López, P. (2018). Physical activity, physical fitness and self-concept in schoolchildren aged between 8 to 12 years old. *Retos. Nuevas Tendencias En Educación Física, Deporte y Recreación*, *35*, 236–241. https://doi.org/10.47197/RETOS.V0I35.64083

Janssen, I., & Leblanc, A. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of*

Behavioral Nutrition and Physical Activity, 7, 40. https://doi.org/10.1186/1479-5868-7-40

Janz, K., Dawson, J., & Mahoney, L. (2002). Increases in physical fitness during childhood improve cardiovascular health during adolescence: The Muscatine Study. *International Journal of Sports Medicine, Supplement*, *23*(1). https://doi.org/10.1055/s-2002-28456

Kyle, T., Mendo, A., Enrique, R., Garrido, R., & Morales Sánchez, V. (2016). Effects of physical activity on self-concept and self-efficacy in preadolescents. *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación*, *29*, 61–65. https://doi.org/10.47197/retos.v0i29.36873

Lim, C. & In, J. (2019). Randomization in clinical studies. *Korean Journal of Anesthesiology*, *72*(3), 221–232. https://doi.org/10.4097/KJA.19049

Lizarazo, L., Burbano Pantoja, V., & Valdivieso Miranda, M. (2020). Correlación entre actividad física y autoestima de escolares adolescentes: un análisis de tipo trasversal. *Revista Virtual Universidad Católica del Norte*, *60*, 95–115. https://doi.org/10.35575/rvucn.n60a6

Manzini, J. (2000). Declaración de Helsinky: Principios éticos para las investigaciones médicas en seres humanos. *Acta Bioethica*, *6*(2), 321–334. https://doi.org/10.4067/S1726-569X2000000200010

Ortega, F., Ruiz, J., España-Romero, V., Vicente-Rodríguez, G., Martínez-Gómez, D., Manios, Y., Béghin, L., Molnar, D., Widhalm, K., Moreno, L. A., Sjöström, M., & Castillo, M. (2011). The International Fitness Scale (IFIS): Usefulness of self-reported fitness in youth. *International Journal of Epidemiology*, *40*(3), 701–711. https://doi.org/10.1093/ije/dyr039

Ortega, Ruiz, J., España-Romero, V., Vicente-Rodríguez, G., Martínez-Gómez, D., Manios, Y., Béghin, L., Molnar, D., Widhalm, K., Moreno, L. A., Sjöström, M., & Castillo, M. J. (2011). The International Fitness Scale (IFIS): Usefulness of self-reported fitness in youth. *International Journal of Epidemiology*, *40*(3), 701–711. https://doi.org/10.1093/ije/dyr039

Palacios, R., Pastor, R., Mendoza, M., & Adsuar, J. (2022). Relación de la calidad de vida relacionada con la salud, con el nivel de actividad física y autopercepción de la condición física en adolescentes peruanos. *E-Motion: Revista de Educación, Motricidad e Investigación*, *18*. https://doi.org/10.33776/remo.vi18.6871

Reyes-Amigo, T., Soto Sánchez, J., & Palmeira, A. L. (2018). Effect of high-intensity intermittent games on cardiorespiratory fitness and body composition in school children: protocol of a randomized controlled trial. *Gymnasium*, *3*(1). https://www.researchgate.net/publication/326437454

Reyes-Amigo, T., & Soto-Sánchez, J. (2021). *Fitness cardiorrespiratorio en la infancia y la adolescencia* (Primera edición). Universidad de Playa Ancha. https://www.researchgate.net/publication/356290275

Rodríguez-Núñez, I., Luarte-Martínez, S., Landeros, I., Ocares, G., Urízar, M., Henríquez, M., & Zenteno, D. (2019). Assessment of EPInfant scale for exercise intensity perceptual self-regulation in healthy children. *Revista Chilena de Pediatría*, *90*(4), 422–428. https://doi.org/10.32641/rchped.v90i4.880

Ruiz, J., Romero, V., Castro Piñero, J., Artero, E., Ortega, F., Cuenca García, M., Pavón, D., Chillón, P., Rejón, J., Mora, J., Gutiérrez, A., Suni, J., Sjöstrom, M., Castillo, M., & Ruiz, J. (2011). ALPHA-fitness test battery: health-related field-based fitness tests assessment in children and adolescents. *Nutrición Hospitalaria*, *26*(6), 1210–1214. https://doi.org/10.3305/nh.2011.26.6.5270

Ruiz-Montero, P., Chiva-Bartoll, O., Baena-Extremera, A., & Hortigüela-Alcalá, D. (2020). Gender, physical self-perception and overall physical fitness in secondary school students: A multiple mediation model. *International Journal of Environmental Research and Public Health*, *17*(18), 1–14. https://doi.org/10.3390/ijerph17186871

Salmon, J., Booth, M., Phongsavan, P., Murphy, N., & Timperio, A. (2007). Promoting Physical Activity Participation among Children and Adolescents. *Epidemiologic Reviews*, *29*(1), 144–159. https://doi.org/10.1093/epirev/mxm010

Sanz, N., Díaz-Aroca, Á., & Alcaraz-Muñoz, V. (2023). Effect of the type of motor interaction required by the game on emotional behaviour in Physical Education classes. *Cultura, Ciencia y Deporte*, *18*(56), 29–33. https://doi.org/10.12800/ccd.v18i56.1959

Segovia, Y., & Gutiérrez, D. (2020). Perception of Exertion, involvement and physical fitness in a HIIT Program in Physical Education. Sport Education Model VS Traditional Approach. *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación*, 38, 151-158. https://doi.org/10.47197/retos.v38i38.73686

Tanner, J., & Whitehouse, R. (1976). Clinical longitudinal standards for height, weight, height velocity, weight velocity, and stages of puberty. *Archives of Disease in Childhood*, 170. https://doi.org/10.1136/adc.51.3.170

Tapia-Serrano, M., Sevil-Serrano, J., Sánchez-Oliva, D., Vaquero-Solís, M., & Sánchez-Miguel, P. (2022). Effects of a school-based intervention on physical activity, sleep duration, screen time, and diet in children. *Revista de Psicodidáctica (English Ed.)*, *27*(1), 56–65. https://doi.org/10.1016/J.PSICOE.2021.06.001

Thomas, J., & Nelson, J. (2007). *Métodos de investigación en actividad física*. Paidotribo.

Vedul-Kjelsås, V., Sigmundsson, H., Stensdotter, A. K., & Haga, M. (2012). The relationship between motor

competence, physical fitness and self-perception in children. *Child: Care, Health and Development*, *38*(3), 394–402. https://doi.org/10.1111/J.1365-2214.2011.01275.X

Velez, A., Golem, D., & Arent, S. (2010). The impact of a 12-week resistance training program on strength, body composition, and self-concept of Hispanic adolescents. *Journal of Strength and Conditioning Research*, *24*(4), 1065–1073. https://doi.org/10.1519/JSC.0B013E3181CC230A

Verstraete, S., Cardon, G., Lr. D., Clercq, D., & De Bourdeaudhuij, I. (2006). A comprehensive physical activity promotion programme at elementary school: the effects on physical activity, physical fitness and psychosocial correlates of physical activity. *Public Health Nutrition*, *10*(5), 477–484. https://doi.org/10.1017/S1368980007223900

Videra-García, A., & Reigal-Garrido, R. (2013). Autoconcepto físico, percepción de salud y satisfacción vital en una muestra de adolescentes. *Anales de Psicología*, 29(1), 141–147. https://doi.org/10.6018/analesps.29.1.132401