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HIITing Health in School: Can High Intensity Interval Training Be a Useful and Reliable Tool for Health on a School-Based Enviroment? A Systematic Review

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Abstract

Context: High-intensity interval training (HIIT) is considered a time-efficient strategy to improve cardiometabolic health markers in children and adolescents. However, the evidence regarding the characterization of each intervention and the quantification of their health effects within the school environment is required.
Objectives: To systematically review the characteristics of HIIT-based interventions during school time and quantify their effects on the health of children and adolescents.
Data Sources: Recommendation of PRISMA for systematic review was applied. The protocol was registered in the PROSPERO repository 2018 CRD42018089017. A search of the literature (2008 - 2018) on the databases PubMed, Web of Science, CINHAL and PsycINFo was carried out.
Study Selection: Twelve publications using HIIT on children and adolescents in a school-based environment were selected. The inclusion criteria were: (1) HIIT; (2) intervention and, (3) type of study.
Data Extraction: The inclusion criteria to the titles and abstracts, or three independent researchers analyzed the articles. PRISMA's recommendation for systematic reviews, Cochrane tool and ROBINS for randomized and non-randomized studies were used.
Results: We identified 12 studies that included a total of 917 children and adolescents; 83% of the interventions were performed during physical education classes. The average duration and intensity of the interventions were 8 weeks and > 90% HR, respectively. The most important variables evaluated and impacted by HIIT were cardiovascular fitness, nutritional status, and physiological wellbeing.
Conclusions: HIIT seems to be a reliable and time-efficient approach to impact especially cardiovascular fitness of children and adolescents during school time. The focus on class intensity and the number of repetitions needs further investigation to find interventions based on each school due to individual differences regarding time and implementation constraints to impact health parameters.

Keywords: High-Intensity Interval Training, School-based Interventions, Children, Adolescents

1. Context

The health benefits provided by physical activity (PA) have been reported for different populations (1). As such, PA is a critical component among children and adolescents due to the positive relationship with physiological well-being, cognition, and improvements in metabolic function (2, 3). It is suggested that children and adolescents must engage in at least 60 minutes of daily moderate to high-intensity PA that incorporates cardiovascular and strength-based activities (4). In this regard, different studies have reported that time and intensity are not evaluated in children or adolescents (5) to whom the surrounding behavior and environment appear to be critical for AP practice (6, 7). Based on this evidence, the practice and commit-

ment to daily and sustained PA by this population seems difficult to achieve and recently, schools have been proposed as the main drivers of health promotion (8). Schools are the perfect and most reliable places to implement activities for improvements in PA levels as this is where children spend over half of their day, and such innovative and evidence-based interventions must be considered an educational, scientific, and sanitary aim (9).

During the last decade, a number of important publications have reported the effects of aerobic exercise and, particularly, of high-intensity interval training (HIIT) in young populations (10). HIIT is a type of training characterized by brief and repeated bursts of intense exercise followed by periods of rest or low-intensity exercise (11). The benefits of HIIT on athletes are well known, and for this reason the clinical applications of this type of training are gaining popularity for their favorable changes of metabolic and cardiovascular risk factors by the manipulation of variables such as intensity, bouts and total exercise duration, rest, repetitions, series, and the type of recovery adapted to each clinical population (12). Among children and adolescents, HIIT has shown greater improvements in cardiovascular profile variables despite the less time of training compared to continuous moderate protocols (13). More recently, Garcia Hermoso et al. (2016) reported on a meta-analysis that HIIT-based exercise needs to be considered a preventive intervention with a time-efficient approach compared with other types of training to improve blood pressure and cardiovascular fitness in young obese populations (14). Besides, this kind of training seems to report better adherence levels, at least in this population (15).

Furthermore, even regarding the current evidence that supports the efficacy of HIIT on cardiovascular risk factors in children and adolescents, the applicability of this type of exercise in a more natural or "real" environment such as school remains unknown. For these reasons, the identification of the methodological approaches and health benefits characteristics of HIIT on a school-based context will provide evidence to the correct and safe utilization by teachers.

2. Objectives

The purpose of this systematic review was to synthesize the characteristics of each intervention that uses HIIT as a tool for the improvement of health markers and to measure the direct effects on cardiovascular fitness, body composition, psychology, and the cognition of school-based interventions in children and adolescents. The information provided by this review will directly contribute to researchers and educators related to PA, especially physical education teachers.

3. Data Sources

This review was constructed following the recommendations of PRISMA (16) for systematic reviews and the current protocol was registered on the PROSPERO database (17).

We carried out comprehensive search strategies on the following databases: PsycINFO, CINAHL, PubMed, and Web of Science. We aimed to identify interventions that used HIIT, considering a school-based context only. The search was limited to humans, age (children and adolescents 6 - 17 years), time span (2008 - 2018) and by language (English and Spanish). The keywords used in this research were: High-intensity interval training OR High-intensity interval exercise OR High-intensity intermittent exercise AND School-based intervention OR intervention OR school. This strategy was adapted to each database used.

4. Study Selection

All studies than met the following criteria were included: (1) HIIT: Studies that apply HIIT intervention reporting the intensity ($\geq$ 80% FC) (8, 9), (2) intervention C: Studies that did not combine HIIT with any other exercise type and that was done on a school-based context (inside school and during school hours and that report cardiovascular fitness, nutritional status, psychologic, and cognitive measurements, (3) type of study: experimental, quasi-experimental and randomized controlled studies were included; reviews, conference abstracts or book chapters were not included.

5. Data Extraction

First, duplicated documents were removed using Mendeley reference manager software. One of the investigators applied the inclusion criteria to the titles and abstracts of each selected article. When a title or abstract did not provide all the necessary information, the text was downloaded and verified by three independent researchers. Differences in the study criteria were discussed among researchers. We also used a form to extract the data of each study to provide a better understating of each methodology. Also, to diminish the risk of bias, we followed the elements provided by PRISMA (16) for systematic reviews. We also used the Cochrane tool for experimental randomized studies (18) and ROBINS for non-randomized (19).

5.1. Strategy for Data Synthesis

We provide a narrative synthesis of the findings from the included studies structuring it around the methods and the procedure related to the HIIT in the school. The main information is also shown in tables. In the discussion, we analyzed the effects of HIIT in a school context and we provided some suggestions for future researches in order to standardize the application of this methodology.

5.2. Risk of Bias Assessment Tools

The tool was applied by two reviews to assess the risk of bias (RoB) of the selected experimental and quasi-experimental studies. Following the same procedure, to assess the RoB of the selected experimental and quasi-experimental studies we applied the "Cochrane Risk of Bias Tool for Randomized Trials" (18) and the "Risk of Bias In Non-randomized Studies of Interventions" (ROBINS-I) (19), respectively.

6. Results

We obtained the titles and abstracts of 75 articles. Once the first filter was applied 68 articles were recovered for revision. Forty-five articles did not meet the inclusion criteria (Three did not meet the HIIT criteria, 34 did not meet the type of intervention criterion, and eight did not include the type of study). Twelve studies were selected for analysis (Figure 1).

Considering RoB, the articles presented a moderate (20-26) to low (27-31) bias score, where sample characteristics, the allocation concealment of participants and the amount of missing data in the outcome measure, were the main reasons for bias and of potential confounding factors.

Table 1 lists all studies have been published since 2013. Three are from South America, one from North America, five from Europe, and three from Oceania. In addition, the number of articles published by country is shown in a map graphic (Figure 2).

A total of 917 children and adolescents participated in the studies, 41% were male with an average age of 12.96 $\pm$ 2.86 years. In addition, 83% of the interventions were performed during physical education classes and the most reported variables where cardiorespiratory fitness (CF) and body composition.

Regarding the background and profession of the person in charge of the intervention in 67%, it was a member of the research team (20-23, 26-29) and in 33%, it was the school physical education teacher (24, 25, 30, 31). In relation to the HIIT modality, the most used activity to induce the desired intensity was running (24-29, 31), through sport-based games along with jumps, squats, and push-ups (20-22, 26, 29-31); additionally, two studies used HIIT on a cycloergometer (22, 30). The repetitions used in the protocols ranged from 4 (20, 22, 28) to 20 (22) and frequency from 1 (27) to 3 weekly sessions (20, 21, 25, 26, 28, 30). Regarding the HIIT interval duration, these were performed from 10 s (24) to 360 s (29) with a mean of 47.81 $\pm$ 84,08 s and the session time was between 1 to 40 min with a mean of 10.42 $\pm$ 12.41 min. The intensity was monitored by the rate of perceived exertion (RPE) (22, 25, 27), maximal aerobic velocity (MAS) (24), anaerobic threshold (29) and the most used indicator was the maximal heart rate (22, 26, 30, 31). Sessions lasted between 4 (28) and 60 (29, 31) min with a mean time of 22.03 $\pm$ 19.33 min. The most frequent duration of the interventions was eight weeks. All data are summarized in Table 2.

Table 3 lists the effects of HIIT interventions on health variables. Eight studies evaluated CF (20, 22-28) but only five report significant improvements compared with other intervention (20, 22, 24, 26, 28). Related to nutritional status: eight studies included this variable among their methodology (20, 22-26, 28), seven use body mass index (BMI) and five waist circumference (21, 22, 24, 29, 31); in two studies the HIIT intervention resulted in improvements in nutritional status (21, 31).

Regarding the effects of the intervention on metabolic, psychologic, and cognitive variables, the results are summarized in Table 4. Only four studies evaluated metabolic aspects (20, 22, 28, 30) and only two included psychological and cognitive aspects (23, 26). In particular, one study showed positive effects on selective attention (23), showing these are promising areas of future research.

7. Discussion

The aim of this systematic review was to synthesize the characteristics of the current interventions that utilize HIIT on a school-based environment and their effect on different health variables of public health concern.

Our results show that 75% of the interventions are performed during the physical activity class, which makes the incorporation of more vigorous activities reliable and possible in a school-based context. According to this observation, the importance of including PA in schools is established (32) and more importantly, it shows that modulating the PA intensity is a fundamental axis for the increment of PA levels and improvements of cardiovascular fitness in children and adolescents (33).

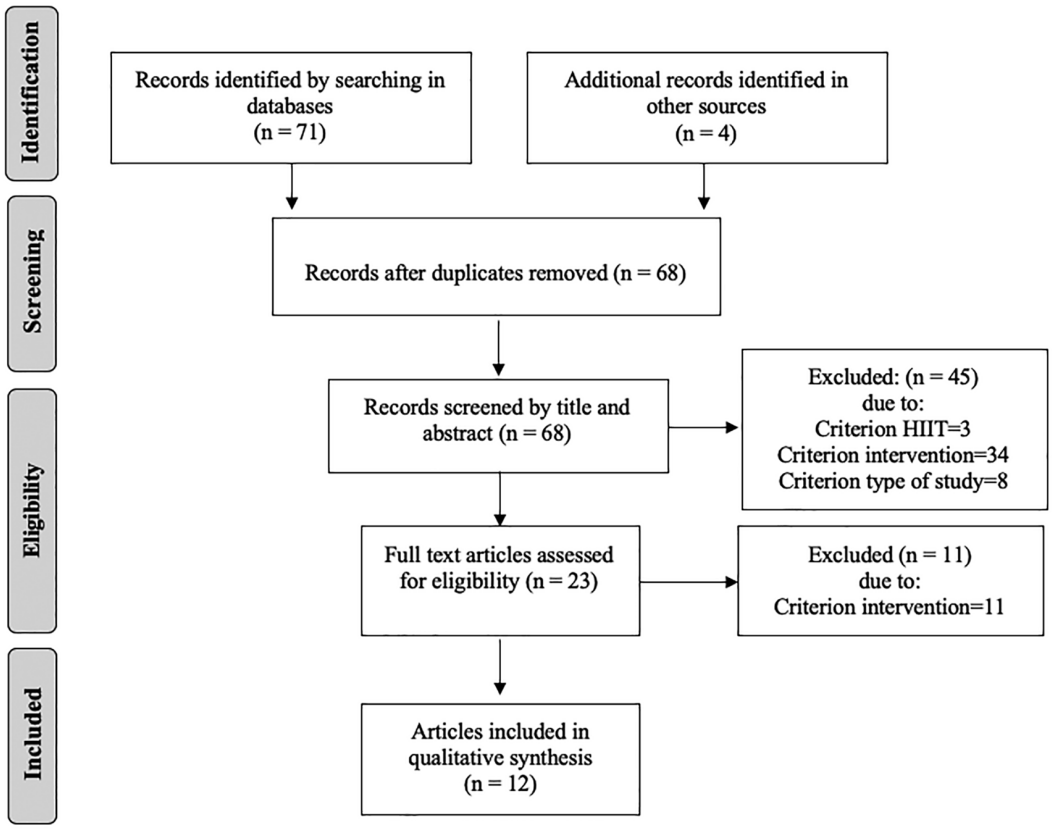

Figure 1. The flow chart illustrates different phases of the search and selection of articles.

It is important to know the characteristics of each intervention as well as their practical and field-based practice because the main strategies utilizing HIIT are oriented toward a sport or clinical context (34), so the appropriate approach and adaptations needed for different populations are fundamental.

Regarding the type of HIIT modality, it can be noted that a high percentage of the interventions used running (58%) and physical games (33%) to induce or modulate intensity during classes, while a minor percentage used static or laboratory-based equipment such as a cycloergometer or treadmills (17%). Research has shown that short but intense sprints have important effects on metabolic and cardiovascular indicators (35) in both adults and obese adolescents (36); for the latter, we suggest that HIIT based activities should be encouraged and included on any school-based intervention that seeks improvements in health variables. For example, Weston et al. (2016) reported that an intervention using HIIT that included sprints and sport movements reduced triglycerides (-26%), waist circumference (-3.9%), and an increase of 16 min on spontaneous moderate-intensity activities on 101 adolescent, with just 4 - 7 repetitions of 45s high-intensity activity for 10 weeks (20).

We found that the main tool for control intensity was HR; > 90%. The HR was the most used intensity with intervals that ranged from 4 - 16 for a period of 10 s to 360 s. Lazzer et al. (2017) recently reported that 3 weeks of intervention at 70% of the HR during HIIT have an important impact on maximal oxygen uptake ($VO2_{max}$) with only 6 intervals of 40s. It is important to mention that despite the improvement of CF, this type of training did not induce any significant changes on nutritional status compared with a low-intensity training (40% HR), with the authors implying that HIIT is an important tool for CF but have a limited impact on body fat loss at least among adolescents (37).

It is important to mention that the length of the interventions is known to be critical to induce expected changes. Costigan et al. (2015) described in a systematic review that the main driver of changes of nutritional status in this population was the length of the interventions, where 8 weeks seems to be the minimum duration in or-

Table 1. Characteristics of The Training Studies

Author, Year, Country (Ref.)	No. (Male)	Average Age	Groups (Numbers of Participants)	Location of Intervention	Variables Measured
Huerta et al., 2017, Chile (24)	28 (not informed)	HIIT: 13.5 ± 0.6; CG: 13.6 ± 0.5	HIIT (14); CG (14)	PEC	CF, nutritional status
Morris et al., 2018, United Kingdom (27)	10 (5)	HIIT ± CG: 9.8 ± 0.6	HIIT (5); CG (5)	PEC - LT	Nutritional status, appetite, CF
Camacho-Cardenosa et al, 2016, Spain (25)	35 (19)	HIIT: 11.06 ± 0.24; CAEG: 11.29 ± 0.47	HIIT (18); CON (16)	PEC	Body composition, subjective perception of effort, CF
Harris et al., 2017, New Zealand (30)	17 (8)	HIIT ± CAEG: 12.9 ± 0.32	HIIT (8); CON (9)	PEC	CF, cortisol, amylase, lactate, subjective perception of effort
Weston et al., 2016, United Kingdom (20)	101 (38)	HIIT ± RTG: 14.1 ± 0.3	HIIT (41); CG (60)	PEC- LT- EXA	CF, lipid profile, body composition, glucose
Costigan et al., 2015, Australia (10)	65 (45)	ATG ± RTG ± CG: 15.8 ± 0.6	ATG (21); RTG (22); CG (22)	PEC - EXA	Executive function, psychological well-being, psychological distress, physical self-concept, emotional state, CF
Fernández et al., 2017, Chile (21)	206 (not informed)	HIIT; CG: (6 a 9) (average age not informed)	HIIT (104); GC (102)	PEC	CF, body composition
Logan et al., 2016, New Zealand (22)	26 (26)	HIIT: 16 ± 1	HIIT (5); (5); (6); (5); (5)	LT	Body composition, CF, glycemia, interleukins, cholesterol
Ma et al., 2015, Canada (23)	88 (44)	Boys + Girls: (9 a 11) (average age not informed)	Boys (44); Girls (44)	Class time (location not informed)	Selective attention
Buchan et al., 2013, United Kingdom (28)	89 (65)	HIIT: 16.8 ± 0.5; CG: 16.6 ± 0.6	HIIT (42); CG (47)	PEC	CF, body composition, blood pressure, heart rate, physical activity behavior, total cholesterol, LDL, CRP, IL-6, adiponectin, glucose, triglycerides, insulin
Lambrick et al., 2016, United Kingdom, (29)	55 (32)	HIIT; CAEG: 9.3 ± 0.9	HIIT; not informed (HITno; HITob); CAEG; not informed (CAEno; CAEob)	PEC	Body composition, CF
Delgado-Floody et al., 2018, Chile, (31)	197 (89)	HIIT; CG: 8.4 ± 1.15	HIIT (151); CG (46)	PEC	Body composition, CF

Abbreviations: ATG, aerobic training group; CAEG, continuous aerobic exercise group; CAEno; continuous aerobic exercise in normal weight subjects; CAEob, continuous aerobic exercise in obese subjects; CF, cardiorespiratory fitness; CG, control group; EXA, extracurricular activity; HIIT, group with high-intensity interval training; HIITno, HITT training group in normal weight; HITTob, HITT training group in obese subjects; LT, lunchtime; PEC, physical education class; RTG, resistance training group.

der to induce important changes on body composition (10). Our results show that the length of the interventions ranged from 2-28 weeks with a mean of 8.56 ± 2.86 weeks, and as such we propose eight weeks is a plausible time period to be employed in order to achieve results on nutritional status with HIIT as the main exercise modality. Also, none of the studies considered nutritional interventions such as counseling, which has been reported to be essential to target weight reduction in children (38). As we mentioned, even if HIIT can promote anthropometrical improvements, most of the interventions on this review report every change, which makes it difficult to establish if between the protocol any of them have a major impact on this variable; this aspect is of great public interest, especially as the current obesity levels among children and adolescents are very worrisome.

Results from HIIT report important changes on CF and on health markers independent of weight loss (39, 40). We found that HIIT induce positive changes on $VO2_{max}$ and on RPE on interventions performed inside the school (Table 3). Despite the differences between the interventions, it appears that increasing the exercise intensity per se is a valid characteristic that needs to be included to improve the children's health.

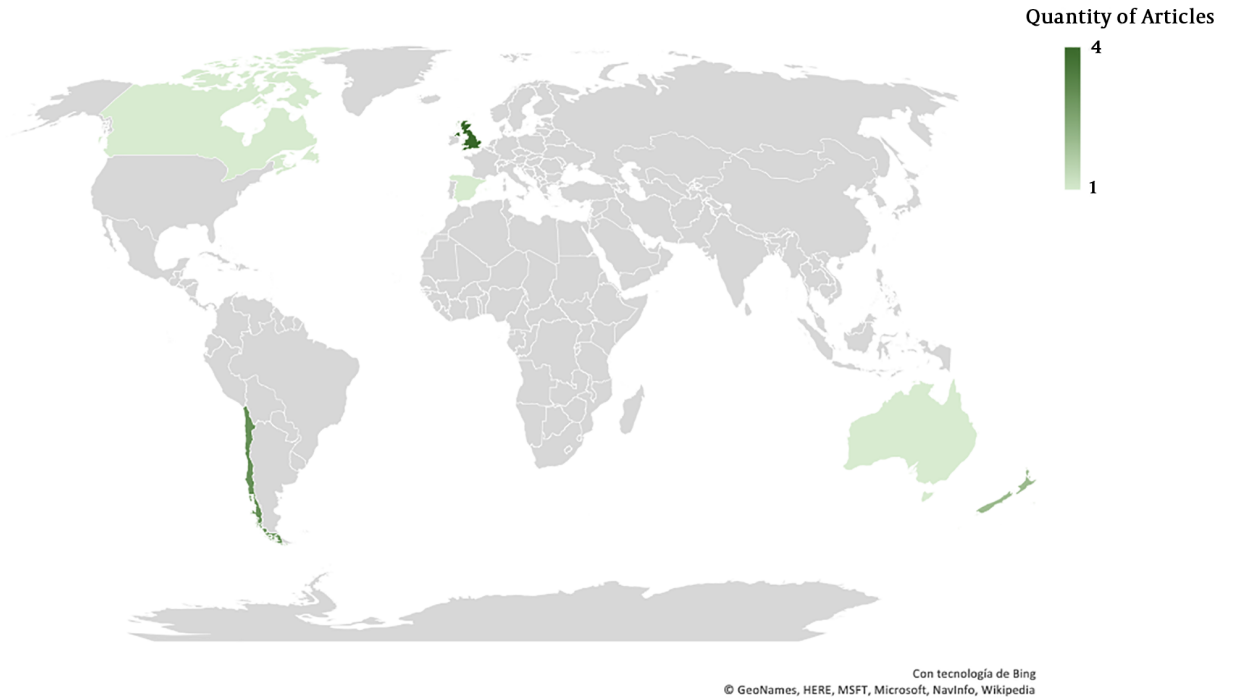

Figure 2. Graphic map of published articles by country is shown. United Kingdom (4), Chile (3), New Zealand (2), Spain (1), Australia (1), and Canada (1).

On the other hand, evidence shows that exercise itself has an important impact on neurocognitive parameters (41, 42). Exercise interventions have reported improvements in cognitive variables substantiated by physiological changes. These have shown an improvement, especially on executive functions (43-45) (e.g. attention control, work memory, and goal achievements) in which CF is the main driver for cognition (46, 47). We found only two studies that reported cognitive variables with HIIT intervention, and favorable changes were reported in both of them. In relation to this, the analysis on the direct relationship between cognition and HIIT deserves more attention by the educational and scientific community who should include cognitive variables together with changes of exercise intensity in schools.

Finally, even if we were able to find a wide range of intensities, frequencies, volumes and variables associated to HIIT on a school-based environment, the evidence is still lacking to establish a unique protocol for a practical application; more short- and long-term investigations are needed for this purpose. This intervention should include parameters of physiologic health that allow shedding the light on the barriers of adherence for this type of training since the results are mixed regarding this issue (4, 48).

Even with the growing evidence regarding the effects of HIIT on physiological changes, there are few studies focusing their interest on clarifying the relationship of this exercise modality with wellbeing and psychological health; in contrast, improvements in psychological health are related to PA practice. Some studies have evaluated the effects of HIIT on mood changes and they have shown no changes regarding this variable but have reported better enjoyment and fun when this training modality is employed (49). These results are of great interest, especially when considering exercise adherence, as an enjoyment is a predictive variable of practice continuity. Noteworthy, more data using protocols are necessary that allow the comparison of subjects with different levels of exercise practice intention (50). Just a few studies have attempted to elucidate the effect of HIIT on psychological variables with mixed results on enjoyment and affection advances. But more recent data point out that obese adolescents have better adherence and delight with adapted HIIT activities (51). This result is promising for the adherence to PA that is scaring during the initial years of life.

In conclusion, HIIT is a time-efficient tool to improve cardiovascular fitness as a cardiovascular protection factor among children and adolescents and is also a remark-

Table 2. Intervention Characteristics

Reference	Professional in Charge	Type of Activity to Generate HIT	HIIT Features	Intensity / Unit of Measure	Number of Intervals	Duration of Intervals (s)	Recovery Time Between Intervals (min)	Exercise Time (min)	Session Time (min)	Sessions per Week	Number of Weeks of Intervention
(20)	PET	Running	20mSRT	95 - 105% MAS	16	10	0.3	5	22	2	8
(27)	Researcher	Running	20mSRT (modified at 17 mt)	RPE max.	6	30	0.5	6	22	1	2
(21)	PET	Running	20mSRT	RPE max.	9	20	3 to 1'; 8 to 0.3"	3	8.7	3	8
(28)	PET	Cycle ergometer, boxing	Mixed	90% HR max o RPE $\geq$7	12	30	0.5	12	6	3	4
(22)	Researcher	Basketball, football, dancing, boxing	Mixed	90 % HR max	4	45	1.5	12	46	3	13
(23)	Researcher	ATG; running, jumping, skipping	Mixed	not informed	8 to 10	30	0.5	4 to 5	8 to10	3	8
		RTG; squats, sprint, push-ups, jumping	Mixed	not informed	8 to 10	30	0.5	4 to 5	8 to 10	3	8
(24)	Researcher	Weightlifting, squats, jumping	Mixed	not informed	not informed	not informed	not informed	not informed	45	3	8
(25)	Researcher	Rowing	Mixed	90 - 100 % HR max	4	20	0.17	1.8	8.5	2	8
		Boxing	Mixed	90 - 100 % HR max	8	20	0.17	3.6	10.3	2	8
		Cycle ergometer	Mixed	90 - 100 % HR max	12	20	0.17	5.5	12.2	2	8
		Treadmill	Mixed	90 - 100 % HR max	16	20	0.17	7.3	14.0	2	8
		Jumping	Mixed	90 - 100 % HR max	20	20	0.17	9.1	15.8	2	8
(26)	Researcher	not informed	not informed	not informed	not informed	20	0.17	not informed	not informed	not informed	3
(29)	Researcher	Running	20mSRT	not informed	4	30	0.5	2	4	3	7
(30)	Researcher	Physical games, running, jumping	Mixed	90% threshold of gas exchange	not informed	360	2	40	60	2	6
(31)	PET	Running, jumping, throwing	Mixed	80 - 95 % HR max	5	60	1	40	60	2	28

Abbreviations: ATG, aerobic training group; HR max, maximal heart rate; MAS, maximal aerobic speed; PET, physical education teacher; RPE, rate of perceived exertion; RPEmax, maximal rate of perceived exertion; RT, resistance training; RTG, resistance training group; 20mSRT20, meter shuttle run test.

Table 3. The Main Effects of the Intervention on Nutritional and Physical Variables

Reference	Fitness Variables		Body Composition and Anthropometric Variables						Cardiovascular Variables				Variables of Consumption and Eating Habits			
	CF	Subjective Perception of Effort	BMI	Fat mass	Lean mass	Height	Weight	WC	HR	BP	SBP	DBP	Carbohydrates	Proteins	Fats	Appetite
(20)	YES	-	NO	-	-	-	-	NO	-	-	-	-	-	-	-	-
(27)	-	-	-	-	-	-	-	-	YES	-	-	-	NO	NO	NO	NO
(21)	-	YES	-	NO	-	-	-	-	YES	-	-	-	-	-	-	-
(28)	NO	NO	-	-	-	-	-	-	NO	-	-	-	-	-	-	-
(22)	NO	-	NO	NO	NO	-	-	NO	-	NO	-	-	-	-	-	-
(23)	-	-	-	-	-	-	-	-	NO	-	-	-	-	-	-	-
(24)	YES	-	YES	-	-	-	-	YES	-	-	-	-	-	-	-	-
(25)	YES	-	NO	YES	YES	-	-	YES	-	-	NO	YES	-	-	-	-
(26)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(29)	YES	-	NO	-	-	NO	NO	NO	-	-	NO	NO	-	-	-	-
(30)	NO	-	NO	NO	YES	NO	-	YES	-	-	-	-	-	-	-	-
(31)	YES	-	YES	YES	-	NO	YES	YES	NO	-	NO	YES	-	-	-	-

Abbreviations: BMI, body mass index; BP, blood pressure; DBP, diastolic blood pressure; HR, heart rate; NO, non-significant; SBP, systolic blood pressure; WC, waist circumference; YES, significant; (-), variable not reported.

able and reliable model to be included in every school environment. The main characteristics that this intervention should possess are at least 8 weeks of duration, the intensity of > 90% HR, interval of 10 - 45 seconds and 4 - 10 repetitions depending on age and individual characteristics to induce improvements in $VO2_{max}$. It is important to men-

Table 4. The Main Results Over Metabolic, Psychologic, and Cognitive Variables

Reference	Metabolic variables											Psychological Variables				Cognitive Variables	
	Amylase	Cortisol	Lactate	Glucose	Insulin	TG	Cholesterol		IL-6	CRP	Adiponectin	Emotional State	Psychological Well-Being	Psychological Distress	Physical Self-Concept	Executive Function	Selective Attention
							LDL	HDL									
(20)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(27)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(21)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(28)	NO	NO	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(22)	-	-	-	NO	-	NO	-	-	-	-	-	-	-	-	-	-	-
(23)	-	-	-	-	-	-	-	-	-	-	-	NO	NO	NO	NO	NO	-
(24)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(25)	-	-	-	NO	NO	-	NO	-	YES	-	-	-	-	-	-	-	-
(26)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	YES
(29)	-	-	-	NO	NO	NO	NO	NO	NO	NO	NO	-	-	-	-	-	-
(30)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(31)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations: CRP, C-reactive protein; HDL, high-density lipoprotein; IL-6, interleukin 6; LDL, low-density lipoprotein; NO, non-significant; TG, triglycerides; YES, significant; (-), variable not reported.

tion that monitoring the intensity by HR still has some bias, and as such on the field and practice, we suggest the use of RPE adjusted to the context of children and adolescents to determine the intensity. Also, we propose the evaluation of psychological parameters along with cognition to control the effect of this intervention. Future research should aim to establish reality-based activities in each educational unit, considering the times and implementation capacity that each school possesses.

Footnotes

Authors' Contribution: Rafael Zapata-Lamana and Matias Javier Monsalves-Alvarez: Study design, data collection, result analysis, manuscript preparation and reviewer response. Igor Cigarroa Cuevas, Claudio Soto Espindola, Victor Fuentes, Eva Parrado Romero, and Carlos Sepulveda: Data collection, result analysis and manuscript preparation.

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