

Systematic Review

Educational Interventions Through Physical Activity for Addiction Prevention in Adolescent Students—A Systematic Review

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Abstract: The growth seen in the number of addictive behaviours related to substance and drug use among adolescents has become one of society's major problems. Several research studies have tried to find answers to this problem, highlighting the potential of physical activity as a prevention method for substance abuse. The aims of this study were (1) to conduct a systematic review analysing the effects of physical activity, exercise or sports-based interventions on substance use among young people and adolescents and (2) to describe and analyse these interventions. To this end, the guidelines of the PRISMA Declaration were followed, and six databases were searched: PubMed, Web of Science (WOS), PsycINFO, ERIC, SPORTDiscus, and SCOPUS. After screening and meeting the proposed eligibility criteria, a total of 10 articles were included. The results provided scientific evidence of the benefits of physical activity in preventing and reducing substance use, most significantly in interventions based on yoga and structured physical activity.

Keywords: substance abuse; physical exercise; sports; drug education; addictive behaviours; health education; secondary education



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1. Introduction

There is currently an increasing number of young people and adolescents showing addictive behaviours related to substance and drug use. Specific data on the increase in substance abuse have been introduced.

In this regard, between 2010 and 2019, the total number of people in the world who used drugs increased by 22 percent (Arteaga-Zambrano & Mendoza-Alcívar, 2022), which has become one of the main problems in society (Tai et al., 2021). This leads to biological, genetic, and social deterioration (Parfilova & Velieva, 2016), thus becoming a threat to the health and well-being of the population as a whole (Hovhannisyan et al., 2020).

Due to the increase in adolescent substance use and its consequences, several research studies have attempted to find answers to the problem (Brook et al., 2015). Some studies show that there are various risk and protective factors, which, interacting with each other, favour or decrease the desire to consume these substances (Larsen & Wiers, 2016). Some of the factors that could be involved in this interaction could be those related to the individual's genetics and development (Van der Zwaluw & Engels, 2009), certain transitional periods in the person's life (Moore & Werch, 2007), various circumstances pertaining to

their immediate context (Larsen & Wiers, 2016), and their affiliation with groups at risk of exclusion (Brook et al., 2015).

The consequences of early substance use, such as tobacco, alcohol, and other drug abuse in young people and adolescents (Odgers et al., 2008), due to their susceptibility and the severe effects of these addictive substances on their developing brains (Brellenthin & Lee, 2018), are, to a greater extent, at the level of executive dysfunction (Oscar-Berman et al., 2014). In addition, Welford et al. (2022) indicate that continued heavy use is associated with various mood disorders, related problems in an educational context (Lewis et al., 2022), or antisocial behaviour, even leading to cases of verbal and physical violence in the person (Lieberman, 2000). In this regard, Kuypers et al. (2016) state that a large proportion of substance use disorders are considered chronic, and the main strategy used to minimise the impact of these disorders is to prevent them as soon as possible (Ceccarini et al., 2014).

In this way, it is crucial to implement interventions that include components of physical activity due to the benefits of physical activity in strengthening regulatory processes in the individual (Weinberg & Gould, 1996), avoiding the desire for harmful reward-seeking behaviours, such as substance abuse (Georgakouli et al., 2017). This is supported by Zschucke et al. (2012), as they indicate that dealing with problems associated with substance abuse involves behavioural modifications that are deeply rooted in the person's lifestyle. In this sense, it could be stated that a complementary technique to modify this lifestyle, with the aim of achieving the cessation or prevention of tobacco, alcohol, and/or other drug use in the individual, could be based on the introduction of physical activity, exercise, or sports in the individual's daily routine (Godínez & Gómez, 2012).

Therefore, due to the characteristics of physical activity and its role in combatting this problem, a recent initiative has emerged with the aim of determining whether any physical exercise is useful in preventing and treating substance use disorders in individuals (Horrell et al., 2020). One of the motives for this reasoning is that while a person is engaged in any behaviour that promotes a healthy state, in this case physical exercise, they cannot simultaneously engage in other behaviours that are detrimental to their health, such as substance use (Ward et al., 2003). On the other hand, the development of key psychological aspects that physical activity produces, such as self-esteem, control of impulsivity, and emotional well-being, could be considered a key aspect in preventing and reducing physical activity (Craft & Perna, 2004). Finally, from a neurobiological point of view, the performance of any sports practice excites reward pathways in the brain, similar to the pathways that are activated when consuming various substances (O'Brien et al., 2011), modulating the serotonergic and dopaminergic system and thus trying to mitigate the desire to consume in the subject (L. Zhang & Yuan, 2019).

Taking into account the benefits that physical activity can bring in reducing and preventing drug use habits (Horrell et al., 2020), it is worth highlighting the considerable role of schools and sports clubs, which carry out structured, supervised, and organised pro-social activities, with the aim of providing protection for this group against risky behaviours that may arise at this stage of life (Lee & Lowe, 2015). However, despite existing evidence on the use of physical activity, exercise, or sports as a treatment for substance use disorders (Lane & DeCamp, 2017), the same is not true for prevention (L. Zhang & Yuan, 2019). Studies in this area have generated some controversy. Aaron et al. (1995) showed a reduction in smoking among girls, but at the same time, an increase in heavy drinking among boys. Along the same lines, Modric et al. (2011) found an increase in alcohol consumption among girls, while levels of tobacco, alcohol, and cannabis decreased among boys. In contrast, Hayes and Tevis (1977) found positive relationships between physical activity and a reduction in the use of various drugs by their study participants.

Some systematic reviews have focused on prevention programmes in sports settings, on the association between participation in physical sports activity and substance use, or on the benefits of physical activity in substance use disorders (Kingsland et al., 2016; Gür & Can, 2020; Mewton et al., 2018; Z. Zhang & Liu, 2022). In this regard, the review carried out by Thompson et al. (2020) focused on the analysis of interventions aimed at the prevention, reduction, and treatment of substance use, although it analysed studies that looked at interventions that did not include programmed physical activity, exercise, or sports. For this reason, to our knowledge, no reviews have been conducted that focus on the effects of implementing programmes that use physical activity, physical exercise, or sports to prevent substance use among young people and adolescents.

The questions that guided the review were the following: Which variables (tobacco, alcohol, cannabis, and/or other drugs) have been most studied when implementing interventions to prevent their use through physical activity, exercise, or sports? Does physical activity, exercise, or sport favour the prevention of substance use among young people and adolescents? In this sense, the objectives of this research were (1) to conduct a systematic review analysing the effects of interventions based on physical activity, exercise, or sports on substance use among young people and adolescents and (2) to describe and analyse these interventions.

2. Materials and Methods

In the present study, we conducted a systematic review of those investigations in which interventions based on the practice of physical activity, physical exercise, or sports (both programmes exclusively focused on the physical component as well as multiple interventions with other components in addition to this) were implemented with the aim of preventing substance use in young people and adolescents. In the preparation of it, the guidelines offered by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement (Page et al., 2021), as well as its guidance on systematic reviews with or without meta-analyses (Moher et al., 2015), were used as a reference. The review methods were established prior to the start of the present study, and the review was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the identification number CRD42023417556 "<https://www.crd.york.ac.uk/PROSPERO/view/CRD42023417556> (accessed on 26 April 2023)".

2.1. Eligibility Criteria

The articles were included according to the following inclusion criteria: (a) research articles published in international journals; (b) studies that carried out the implementation of programmes that included the practice of physical activity, physical exercise, or sports based on the prevention of substance use, in addition to the analysis of their effect; (c) interventions applied exclusively to young people and/or adolescents; (d) studies written in Spanish, English, or Portuguese; (e) studies with the inclusion of pre-test and post-test measures; (f) articles available in full text; (g) research that was an intervention, experimental study, quasi-experimental study, or randomised controlled trial; and (h) studies that met the quality criteria based on "Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields" (Kmet et al., 2004).

In terms of exclusion criteria, the following were proposed: (a) studies based on systematic or literature reviews (e.g., Thompson et al., 2020); (b) manuscripts understood as opinion articles, theses, conference proceedings, books, or book chapters; (c) interventions that did not address substance use prevention and were not delivered to people outside the youth or adolescent stage (e.g., Fagan et al., 2021); and finally, (d) reports not available in full text.

Some articles were also incorporated through an exhaustive analysis of the references provided by the reports included to be described in this review, as well as through the search of databases for articles related to the manuscripts included in them.

2.2. Source of Information and Search Strategies

The search was carried out between the months of December 2024 and January 2025 in six databases: PubMed, Web of Science (WOS), PsycINFO, ERIC, SPORTDiscus full text, and SCOPUS. The next search phrase was formulated and adjusted according to the specific syntax and requirements of each database. ("Addiction Prevention") AND ("Drugs" OR "Alcohol" OR "Cannabis" OR "Marijua-na" OR "Tobacco" OR "Substance Use" OR "Legal Drugs" OR "Illegal Drugs" OR "Narcot-ics") AND ("Physical Activity" OR "Exercise" OR "Sports") AND ("Children" OR "Youths" OR "Adolescents") AND ("Intervention" OR "Experimental" OR "Quasi-experimental" OR "Randomised Controlled Trial").

2.3. Study Selection and Data Extraction Process

After developing the search for the different studies in each database, with the filters applied, a total of 579 papers were obtained. After examining the titles and abstracts of each one and excluding the studies that were not compatible with the eligibility criteria proposed in this research, 10 publications were eventually selected and included in this systematic review. In order to reduce selection bias, data extraction was performed by two investigators individually. In the case of discrepancies, these were resolved by consulting the third investigator.

2.4. Quality Assessment

Once the articles were selected to be analysed in the review, they were subjected to a quality assessment using the "Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields" (Kmet et al., 2004) tool for quantitative studies. Each report was exposed to a total of 14 items, which related to the research design, the characteristics of the sample, the methodology used, the data analysis, and the way in which the results and conclusions of the study were presented. These items were scored in relation to the degree of satisfaction or dissatisfaction with them within each investigation: 2 (satisfactory), 1 (partially satisfactory), 0 (unsatisfactory), and NA (not applicable). The final score was obtained with the following formula [("satisfactory numbers" \times 2) + ("partially satisfactory numbers" \times 1)/28 - ("not applicable numbers" \times 2)]. The scores obtained were expressed as percentages, ranging from 0 to 100%. Two researchers assessed the quality of the studies on a case-by-case basis, seeking as much objectivity as possible. Where discrepancies were found, they were resolved by the third researcher included in the research.

3. Results

3.1. Selection of Studies

Figure 1 shows a flowchart summarising the most important results of the search carried out. After searching for the different studies in each database, with the filters applied, we obtained an initial 579 documents from (1) PubMed ($n = 213$); (2) Web of Science ($n = 10$); (3) PsycINFO ($n = 81$); (4) ERIC ($n = 3$); (5) SPORTDiscus full text ($n = 267$); and (6) SCOPUS ($n = 5$) for examination. These reports were then subjected to a screening and analysis based on reading the titles and abstracts in order to select research papers in accordance with the subject matter presented. After this first screening, a total of 572 documents were excluded for the following reasons: (1) duplicates ($n = 30$); (2) they were systematic reviews or meta-analyses ($n = 21$); (3) they did not correspond to the topic

($n = 476$); (4) they did not implement interventions that involved physical activity, physical exercise, or sport ($n = 3$); (5) Pre- and post-test measures were not given ($n = 3$); (6) the sample was not composed of young people or adolescents ($n = 1$); (7) they were not articles ($n = 37$); and (8) it was not written in Spanish, English, or Portuguese ($n = 1$). In this way, a total of seven articles from the different databases were included. On the other hand, 12 more studies were identified via other methods (after examining the references of the included articles and searching for related articles in the databases analysed), as follows: reports extracted through reference lists ($n = 5$) and (2) studies selected by searching for articles related to previously selected documents in the databases ($n = 7$). Of these 12 studies, after analysing the title and abstract and the screening process, 3 articles were included in the study. Finally, a total of 10 publications were included in the review, in which interventions that were carried out through programmes based on the practice of physical activity, physical exercise, or sport were implemented with the aim of preventing the use of tobacco, alcohol, and/or drugs in young people and adolescents.

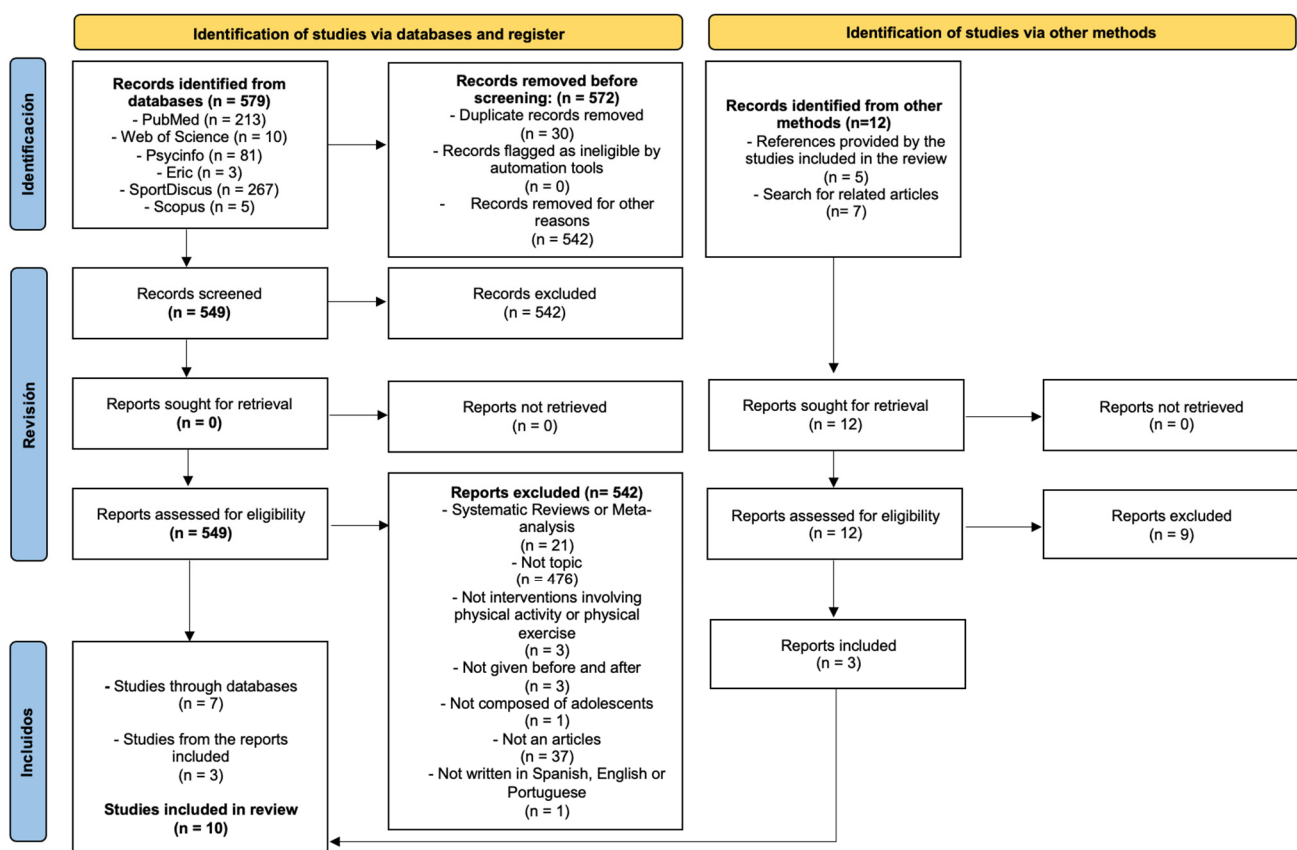


Figure 1. Flowchart of the systematic review process according to the PRISMA protocol declarations.

3.2. Quality of Studies

The quality scores of the articles were expressed as percentages, ranging from 0 to 100% and ranging from 0.65 to 0.92 (see Table 1). Inter-rater agreement was calculated using the intra-class correlation coefficient, yielding a score of 0.905 ($p < 0.001$), indicating superb agreement (Koo & Li, 2016). After implementing the inter-rater agreement, a moderate cut-off point was agreed upon for their selection, including studies with scores of no less than 65% (>0.65). The overall scores ranged from 0.65 to 0.92 (first observer) and from 0.65 to 0.83 (second observer).

Table 1. Assessment of the quality of studies.

Studies	Observer 1	Observer 2
Schijven et al. (2020)	0.78	0.78
Butzer et al. (2017)	0.92	0.82
Sidhu et al. (2016)	0.86	0.83
Fishbein et al. (2015)	0.84	0.75
Espada et al. (2014)	0.85	0.78
Melnyk et al. (2013)	0.92	0.78
Sun et al. (2007)	0.78	0.71
Collingwood et al. (2000)	0.65	0.65
Goldberg et al. (2000)	0.78	0.75
Collingwood et al. (1991)	0.70	0.65

3.3. Characteristics of the Studies

Below are the main characteristics extracted from the 10 studies included in the review (Table 1), alongside data related to the country where each intervention was conducted, the study design and duration, participant characteristics (gender, age, contextual data, etc.), the variables measured, and the instruments used in the study (Table 2). On the other hand, Table 3 shows the data related to the objective and hypothesis of the study, the programme followed in the intervention, and the main results, conclusions, and limitations of each study.

Table 2. Characteristics of the study and participants, variables assessed, and assessment instruments.

Studies /Authors	Country	Design	Duration of Study	N (Gender) N (CG y EG)	Age Subjects	Characteristics of the Participants	Variables
Schijven et al. (2020)	The Netherlands	Quasi-experimental, with pre-test and post-test measures (1 CG/1 EG). No long-term follow-up evaluations were executed.	6 weeks, 5 group sessions of 45 min each; 5 individual sessions of 30 min each; a total of 10 sessions	66 participants (19 girls) (47 girls) CG: 32 (12 girls; 20 boys) EG: 34 (7 girls; 27 girls)	NR M = 17.45 SD = 2.76 CG: (M = 17.72; SD = 2.88) EG: (M = 17.21; SD = 2.67)	Overall, 24% of the adolescents were frequent alcohol users, reporting weekly or daily alcohol consumption at baseline, 41% used cannabis weekly or daily, and 20% used illicit drugs weekly or daily. Furthermore, 23% of participants reported being daily or weekly poly-drug users of tobacco, cannabis, and/or other drugs at the start of the study.	“Risk profile in the use of tobacco, cannabis and/or other drugs” “Frequency of use of alcohol, cannabis and/or other drugs” “Binge drinking” “Severity of alcohol, cannabis and/or other drug use”
Butzer et al. (2017)	United States	Randomised controlled trial, with pre-test and post-test measures (1 CG/1 EG). Long-term follow-up evaluations (6 and 12 months).	6 months 1–2 weekly sessions of 35 min each A total of 48 sessions	209 participants (132 girls) (77 girls) CG: 93 (61 girls; 32 boys) EG: 116 (71 girls; 45 girls)	12–13 years old M = 12.64 SD = 0.33	ESO students (7th grade) considered high-performing, from a public school with a variety of ethnic and socio-economic backgrounds (mainly included those students with a lower-middle socio-economic level). Participants reported being users of tobacco, alcohol, cannabis, and/or other drugs at the start of the study. The demographics also suggest that the study sample was composed primarily of White and Asian students.	“Willingness and frequency to use tobacco, alcohol, cannabis and/or other drugs” “State of mind” “Stress” “Impulsivity” “Emotional self-regulation” “Quality of the programme”
Sidhu et al. (2016)	India	Quasi-experimental, with pre-test and post-test measures. Long-term follow-up assessment (3 months).	6 weeks; 1–2 weekly sessions of 40–45 min each; a total of 8 sessions	624 participants (262 girls) (362 girls) CG: 303 EG: 321	16–18 years old CG: (M = 16.15; SD = 0.61) EG: (M = 16.16; SD = 0.90)	ESO students from four different schools (two public and two private schools). Overall, 58% of the sample was male, 66% of the sample attended public schools, and only 16 or approximately 3% of participants reported being monthly tobacco smokers at the start of the study.	“Tobacco use” “Quality of the programme”

Table 2. Cont.

Studies /Authors	Country	Design	Duration of Study	N (Gender) N (CG y EG)	Age Subjects	Characteristics of the Participants	Variables
Fishbein et al. (2015)	United States	Randomised controlled trial, with pre-test and post-test measures (1 CG/1 EG). No long-term follow-up evaluations were executed.	7 weeks 3 weekly sessions of 50 min each A total of 20 sessions	85 participants (46 girls) (39 girls) CG: 40 EG: 45	14–20 years old M = 16.70 SD = NR	ESO students (9–12th grade) with a high risk of school absenteeism and dropout, belonging to a specific public school for students with academic, family, and/or personal problems. Participants reported being users of alcohol, cannabis, and/or other drugs at the start of the study, and many students entered the school behind by 1–2 years in course credits, due to absenteeism, academic issues, or personal/family problems.	“Use of alcohol, cannabis and/or other drugs” “Physical fitness” “Emotional behaviour” “Stress” “Benefits gained through mindfulness” “State of mind” “Behavioural conduct” “Physiological aspects”
Espada et al. (2014)	Spain	Randomised controlled trial, with pre-test and post-test measures (3 CGs/3 EGs). No long-term follow-up evaluations were executed.	6 weeks 1–2 weekly sessions of 40–45 min each A total of 8 sessions	1546 participants (711 girls) (835 girls) CG: 716 EG: 830	14–21 years old M = 15.26 SD = 1.20	ESO students from six schools in the province of Alicante (Spain). Approximately 32% of the participants had smoked a cigarette sometime in their lives and in the last 30 days, and 7.1% had on the day of the pretest assessment.	“Tobacco use/intention to use” “Nicotine dependence” “Acquired knowledge about consequences of tobacco use” “Quality of the programme”
Melnyk et al. (2013)	United States	Randomised controlled trial, with pre-test and post-test measures (1 CG/1 EG) Long-term follow-up assessment (6 months).	4 months 1 weekly session of 20 min each A total of 15 sessions	779 participants (402 girls) (377 girls) CG: 421 (207 girls; 214 boys) EG: 358 (195 girls; 163 girls)	14–16 years old M = 14.74 SD = 0.73 C.G.: (M = 14.74; SD = 0.70) EG: (M = 14.75; SD = 0.76)	ESO students from 11 schools in the southwestern United States (the choice of schools was designed to provide diversity across race/ethnicity) enrolled in health education courses. Participants reported being alcohol and/or cannabis users at the start of the study.	“Alcohol and/or cannabis use” “Healthy lifestyle” “Body Mass Index” “Mental health” “Academic performance”

Table 2. Cont.

Studies /Authors	Country	Design	Duration of Study	N (Gender) N (CG y EG)	Age Subjects	Characteristics of the Participants	Variables
Sun et al. (2007)	United States	Randomised controlled trial, with pre-test and post-test measures (6 CGs/6 EGs). No long-term follow-up evaluations were executed.	6 weeks 1–2 weekly sessions of 40–45 min each A total of 8 sessions	878 participants (352 girls) (526 girls) CG: 391 EG: 487	13–19 years old M = 16.50 SD = 1.00	ESO students from 12 schools in Southern California (US USA). A total of 33% of participants reported being weekly tobacco smokers at the start of the study. Approximately 52% of the students reported that they may smoke in the next 12 months.	“Tobacco use/intention to use” “Acquired knowledge about consequences of tobacco use” “Programme quality”:
Collingwood et al. (2000)	United States	Quasi-experimental, with pre-test and post-test measures (0 CGs/6 EGs). No long-term follow-up evaluations were executed.	3 months; 3 weekly sessions of 90 min each (secondary school) and 120–180 min each (community centre); a total of 36 sessions	329 participants (142 girls) (187 girls) CG: 0 EG: 329 3 EGs—secondary school: 111 (48 girls; 63 boys) 3 EGs—community centre: 218 (94 girls; 124 girls)	NR M = 12.13 SD = NR 3 EG secondary school: (M = 12.80; SD = NR) 3 EG community centre: (M = 14.46; SD = NR)	Youngsters from three high schools and three community centres, located in environments at risk of exclusion, established in small rural and urban areas of the city of Illinois. Participants reported being users of tobacco, alcohol, cannabis, and/or other drugs at the start of the study.	“Physical fitness” “Level of physical activity” “Risk factors in the use of tobacco, alcohol, cannabis and/or other drugs” “Use of tobacco, alcohol, cannabis and/or other drugs” “Quality of the programme”
Goldberg et al. (2000)	United States	Randomised controlled trial, with pre-test and post-test measures (16 CGs/15 EGs). Long-term follow-up assessment (12 months).	4 months 1–2 weekly sessions of 45 min each A total of 22 sessions	2516 participants (0 girls) (2516 chicas) CG: 1371 EG: 1145	15–16 years old M = 15.45 SD = NR CG: (M = 15.42; SD = 1.20) EG: (M = 15.48; SD = 1.19)	High school students (9th and 10th grade) from 34 schools in the Portland metropolitan area (USA). Participants reported being users of anabolic steroids, alcohol, and/or other drugs at the beginning of the study. Subjects belonged to a professional football team at their high school.	“Intention to use anabolic steroids” “Healthy diet” “Knowledge acquired about consequences of the use of sports supplements, consumption of anabolic steroids, alcohol and/or other drugs” “Intention to use alcohol and/or other drugs (cannabis, amphetamines or narcotics)”

Table 2. Cont.

Studies /Authors	Country	Design	Duration of Study	N (Gender) N (CG y EG)	Age Subjects	Characteristics of the Participants	Variables
Collingwood et al. (1991)	United States	Quasi-experimental, with pre-test and post-test measures (0 CGs/3 EGs). No long-term follow-up evaluations were executed.	9 weeks 2 weekly sessions of 90 min each A total of 18 sessions	74 participants (28 girls) (46 girls) CG: 0 EG: 74 1st EG—secondary school: 54 2nd EG—community centre: 11 3rd EG—health centre (hospital): 9	NR M = 16.80 SD = NR 1st EG—secondary school: M = 17.50 SD = NR 2nd EG—community centre: M = 15.10 SD = NR 3rd EG—health centre (hospital): M = 15.10 SD = NR	High-risk adolescents reported being tobacco, alcohol, and/or cannabis users at the start of the study, at risk of dropping out of school, and substance users from a high school, a community centre, or a hospital in the city of Dallas.	“Physical fitness” “Risk factors related to tobacco, alcohol and/or cannabis use” “Use of tobacco, alcohol and/or cannabis”

N: sample size; M: mean; SD: standard deviation; ESO: secondary school; USA: United States; CG: control group; EG: experimental group; NR: not reported.

Table 3. Aim, intervention programme, main results, conclusions, and limitations of the research.

Studies /Authors	Aim of the Study	Intervention Programme		Main Results	Conclusions	Limitations
		Control G.	Experimental G.			
Schijven et al. (2020)	Aim: to evaluate the short-term effectiveness of the alcohol, cannabis and/or other drug prevention programme “Take it personal!” for Dutch adolescents with mild intellectual disabilities, borderline intellectual functioning, and delinquent behavioural problems.	Regular care was carried out, based on prevention and intervention programmes (without any PA, PE, or sports) against substance use (tobacco, cannabis, and/or other drugs).	The “Take it personal!” programme was implemented, focusing on four personality traits: (1) sensation seeking; (2) impulsive behaviour; (3) sensitivity to anxiety; and (4) negative thinking. Each session was adjusted to the cognitive abilities of the participants.	A stronger decrease was developed for the EG, both in the frequency of cannabis and/or other drug use as well as in heavy alcohol use, compared to the CG. No significant differences were found for the severity of alcohol, cannabis, and/or other drug use between the CG and EG.	A prevention programme aimed at reducing the use of alcohol, cannabis, and/or other drugs in Dutch adolescents with mild intellectual disabilities, borderline intellectual functioning, and delinquent behavioural problems helps to achieve a decrease in the frequency of cannabis and/or other drug use, as well as short-term heavy alcohol consumption.	No randomisation of participants in the study Small size of the participating sample Evaluation of short-term results The personality profiles sensation-seeking and impulsive behaviour were overrepresented

Table 3. Cont.

Studies /Authors	Aim of the Study	Intervention Programme		Main Results	Conclusions	Limitations
		Control G.	Experimental G.			
Butzer et al. (2017)	Aim: to test the short- and long-term effectiveness of Kripalu Yoga in Schools (KYIS), a yoga programme that aims to prevent and reduce risk factors for tobacco, alcohol, cannabis, and/or other drug use in US adolescents.	The usual physical education classes were held. Each session followed the following structure: (1) warming up (light jogging, aerobic movements, or muscle exercises); (2) playing games (relay races, jumping rope, aerobic exercises, etc.) or sports (football, volleyball, basketball, hockey, kickball, and wiffle ball); and (3) relaxation.	A modified 32-session version of the Kripalu Yoga in Schools (KYIS) programme was implemented. Each session followed the following structure: (1) warm-up (breathing and centring exercises); (2) yoga postures (warrior, triangle, sun salutations, etc.); (3) experiential didactic content (student-led yoga postures); and (4) relaxation (ocean breathing, three-part breathing, etc.). Throughout the sessions, yoga postures were gradually added with increasing rigour. All implemented sessions focused on mindfulness, self-regulation, and meditation.	CG participants were more willing to try cigarette smoking immediately after the intervention than EG participants. However, there were no significant differences in the willingness to use alcohol, cannabis, or other drugs between the two groups. No significant differences were found in any of the other variables either. The long-term results revealed improvements in emotional self-control for the female gender EG, as well as for the male gender CG.	Yoga at school has beneficial effects on willingness to smoke cigarettes while preventing risk factors related to the use of tobacco, alcohol, cannabis, and/or other drugs and developing improved emotional self-control in American adolescents.	Sampling bias due to consent/assent process in the study sample All of the outcome measures were self-reporting in nature, which may have led to bias and/or dishonesty in student responses Relatively small effect and sample size
Sidhu et al. (2016)	Aim: to investigate the short- and long-term effects of the tobacco prevention/cessation programme "Project-EX" with adolescent Indian students.	Standard care was provided, including tobacco prevention or cessation activities (if any) provided by the school.	A version adapted to the Indian context of the programme called "Project-EX", based on the clinical programme (Sussman et al., 2001), was implemented.	A 100% smoking cessation rate was experienced, irrespective of status (CG/EG). Although the drop-out rate was not significant, there was a significant prevention effect in adolescents from the both the CG and EG.	A programme for Indian adolescents aimed at preventing/quitting tobacco use helps to strengthen their commitment to stay tobacco-free if they have never used it or stay tobacco-free if they have quit.	Lack of an evaluation related to the fidelity of the implementation (the only data collected by the facilitators were from the ratings of the participants) Limited intervention and evaluation periods (3 months follow-up) Reduced rate of self-reported tobacco use at the start of the study

Table 3. Cont.

Studies /Authors	Aim of the Study	Intervention Programme		Main Results	Conclusions	Limitations
		Control G.	Experimental G.			
Fishbein et al. (2015)	Aim: to assess the impact of a yoga intervention called "Hatha Vinyasa Flow" regarding the use of alcohol, cannabis, and/or other drugs and their psychological and psychophysiological correlates in US adolescents at a high risk of dropping out of school.	The students attended their regularly scheduled classes, with no active treatment (PA, PE, sports, etc.).	<p>A version of mindful yoga was implemented based on guidelines by Miller et al. (2014), called "Hatha Vinyasa Flow", which consisted of a sequence of basic yoga postures. Each session followed the following structure: (1) warm-up (breathing exercises, meditation, and centring); (2) stretching and gentle movements; (3) yoga postures (bending forward, backward, balancing, etc.); and (4) relaxation (meditation).</p> <p>Throughout the sessions, yoga postures were gradually added with increasing rigour.</p> <p>Each session concluded with an affirmation of respect for oneself and others.</p>	<p>A decrease in the frequency of alcohol, cannabis, and/or other drug use was found for the EG, as well as a higher use rate for those participants belonging to the CG.</p> <p>There was an increase in social skills in the EG participants, while they decreased for those in the CG. The same was true, albeit inversely, for stress level scores.</p> <p>No differences were found for mindfulness, emotional regulation, and behavioural self-regulation variables between the CG and EG participants.</p>	<p>Providing yoga in the school setting leads to a short-term decrease in alcohol use as well as improved social skills in US adolescents at risk of dropping out of school.</p>	<p>Potential biases in the reports obtained by the teaching staff</p> <p>The students self-selected themselves for the study and more than likely had some interest in yoga</p> <p>Small size of the participating sample</p>
Espada et al. (2014)	Aim: to report on the short-term results provided by the smoking prevention/cessation programme "Project-EX" with Spanish adolescent students.	Standard care was provided, including tobacco prevention or cessation activities (if any) provided by the school.	A version adapted to the Spanish context of the programme called "Project-EX", based on the clinical programme (Sussman et al., 2001), was implemented.	<p>Significant differences were found in the levels of reduction in intention to smoke in those participants in the EG compared to those in the CG.</p> <p>Similarly, there was a lower level of nicotine dependence on the part of the EG, although not significantly so. Alternative medicine activities (yoga and meditation) received the highest satisfaction scores from EG participants.</p>	<p>An intervention for Spanish adolescents aimed at preventing/quitting tobacco use helps to strengthen, in the short term, their commitment to remain tobacco-free if they have never used or to remain tobacco-free if they have already quit.</p> <p>Above all, it shows potentially more promise in preventive measures.</p>	<p>Limited intervention and evaluation periods</p> <p>Lack of an evaluation related to the fidelity of the implementation</p> <p>The study only pertains to immediate effects</p> <p>Recruitment was not easy in Spanish high schools because of low motivation among staff to add extra-curricular activities in the schedule</p> <p>The dropout rate at immediate postprogram questionnaires was 22.2%</p>

Table 3. Cont.

Studies /Authors	Aim of the Study	Intervention Programme		Main Results	Conclusions	Limitations
		Control G.	Experimental G.			
Melnyk et al. (2013)	Aim: to test the short- and long-term effectiveness of an intervention aimed at preventing alcohol and cannabis use, consisting of a dual programme: “COPE (Creating Opportunities for Personal Empowerment)” and “Healthy Lifestyles TEEN (Thinking, Emotions, Exercise, Nutrition) Program”, versus a control condition programme called “Healthy Teens”, with US adolescents.	The “Healthy Teens” programme was carried out, focusing on health and safety aspects (dental care, infectious diseases, etc.).	A unified version of the “COPE” and “Healthy Lifestyles TEEN” programmes focusing on educational and cognitive behavioural skill development was implemented, with an integration of PA (walking, kick-boxing movements, dancing, etc.) as a component of each session.	A significant reduction rate in alcohol consumption was experienced for EG participants. More favourable scores for BMI, social skills, and academic performance were also obtained for this group. On the other hand, anxiety and depression scores were reduced in both CG and EG. After the six-month intervention, all variables remained the same or developed beneficially, with the exception of the levels of cannabis use, which increased in both groups.	A dual intervention programme aimed at preventing substance use improves both short- and long-term outcomes of healthy living, academic performance, and alcohol use in US adolescents.	Deviations obtained in intervention fidelity scores. The two groups of students differed on some variables at baseline (e.g., weight, TV viewing time).
Sun et al. (2007)	Aim: to investigate the short-term effects of a tobacco prevention/cessation programme called “Project EX” with US adolescent students.	Standard care was provided, including tobacco prevention or cessation activities (if any) provided by the school.	A school-adapted version of the “Project-EX” programme was implemented, based on the clinical programme (Sussman et al., 2001).	Significant differences were found in the reduction in smoking intention/use-related levels in participants from all EGs compared to those from CGs. Levels of substance use knowledge significantly increased in a positive manner for participants in all EGs.	An intervention for American adolescents aimed at preventing/quitting tobacco use helps to strengthen, in the short term, their commitment to remain tobacco-free if they have never used or to remain tobacco-free if they have already quit.	Generalisation of findings, limited to a population with restricted access to pre-measurement of the intervention

Table 3. Cont.

Studies /Authors	Aim of the Study	Intervention Programme		Main Results	Conclusions	Limitations
		Control G.	Experimental G.			
Collingwood et al. (2000)	Aim: to test the short-term efficiency of implementing physical training exercises through the “First Choice” programme as a prevention intervention for the abuse of tobacco, alcohol, cannabis, and/or other drugs in adolescents from US schools and community centres in environments at risk of exclusion.	This study did not have a comparison CG.	The “First Choice” fitness programme was implemented, based on personal training and learning values and life skills through exercise.	A reduction in the number of participants who were previously substance users was experienced in all intervention groups. In addition, there was an increase in physical fitness in participants in all intervention groups, as well as higher levels of PA performed and a reduction in risk factors related to the abuse of tobacco, alcohol, cannabis, and/or other drugs, although these were more significant for participants belonging to the community centre EGs.	The “First Choice” fitness programme is seen as a practical intervention for the prevention and short-term treatment of tobacco, alcohol, cannabis, and/or other drug use behaviours, as well as for increasing PA levels in US adolescents at risk of exclusion.	The priority for school and service agencies serving these youth is programme delivery, not evaluation Low rate of study participants who provided feedback on the data obtained Self-reported data from survey participants Non-existence of an untreated CG
Goldberg et al. (2000)	Aim: to examine the short- and long-term effectiveness of a gender-specific, football team-focused programme designed to reduce intentions to use anabolic steroids, alcohol, and/or other drugs (cannabis, amphetamines, or narcotics) in US adolescent athletes.	A pamphlet (Beete, 1994) was administered, containing generic prevention and health promotion material. This pamphlet emphasised the adverse effects of the use of anabolic steroids, alcohol, and other drugs (cannabis, amphetamines or narcotics) in sports, as well as the benefits of a correct sports nutrition diet.	A programme integrating two components was implemented: (1) Classroom plan: the negative effects of the use of anabolic steroids as well as the use of alcohol and other drugs (cannabis, amphetamines or narcotics) in sports were addressed. In addition, information on sports nutrition was provided through a guide with suggested meal plans. (2) Strength training: Group strength training sessions (6–8 participants) were held in the weight room.	Intention to use alcohol and/or other drugs (cannabis, amphetamines, and narcotics) was not reduced through short-term effects. On the other hand, improvements were shown with regard to the knowledge acquired in relation to the use of anabolic steroids, alcohol, and other drugs (cannabis, amphetamines, and narcotics), resulting in higher levels of healthy behaviours among participants of all EGs. Twelve months after the intervention, all variables had similar scores, except for intention to use alcohol and/or other drugs (cannabis, amphetamines, and narcotics), which did decrease for participants in all EGs.	An anabolic steroid, alcohol, and/or other drug (cannabis, amphetamines, and narcotics) prevention programme produces both short- and long-term improvements in the acquisition of healthy behaviours and decreases the intention to use these substances in US adolescent athletes.	Self-reported data from survey participants Study power was limited as anabolic steroid use was lower than expected

Table 3. Cont.

Studies /Authors	Aim of the Study	Intervention Programme		Main Results	Conclusions	Limitations
		Control G.	Experimental G.			
Collingwood et al. (1991)	Aim: to assess the short-term effectiveness of physical training (as an integrated element in the programming of an intervention) for substance-abusing adolescents participating in tobacco, alcohol, and/or cannabis prevention settings (based on secondary school) and treatment (community and health centre (hospital)).	This study did not have a comparison CG.	<p>A physical fitness programme was implemented, both for participants in each intervention group as well as for their parents, guardians, or legal caregivers. The intervention focused on three main components: (1) fitness and exercise training programme; (2) parent training; and (3) computerised fitness assessment system with built-in reinforcement for participants.</p> <p>Regardless of the intervention group, all participants received the same fitness programme modules and exercise prescription.</p>	<p>There was a reduction in the number of participants who previously used tobacco, alcohol, and/or cannabis, as well as an increase in abstinence in all intervention groups, although these were not significant.</p> <p>There was also a reduction in risk factors related to substance abuse (tobacco, alcohol, and/or cannabis), as well as an increase in the level of physical fitness in all participants belonging to the three EGs, although these data were not significant either.</p>	<p>A physical fitness programme is considered an effective short-term intervention for preventing and reducing substance use (tobacco, alcohol and/or cannabis), as well as helping to reduce risk factors for substance use and increase PA levels in adolescents at high risk of social exclusion.</p>	<p>Small size of the participating sample</p> <p>Self-reported data from survey participants</p> <p>Non-existence of an untreated CG</p> <p>Factors such as test or protocol familiarity and lack of initial motivation, often symptomatic with this population, could have affected underestimated baseline scores for the sample</p>

PA: physical activity; PE: physical exercise; BMI: body mass index; CG: control group; EG: experimental group.

4. Discussion

The aim of this research was twofold: (1) to conduct a systematic review analysing the effects of interventions based on physical activity, exercise, or sports on substance use among young people and adolescents and (2) to describe and analyse these interventions.

Regarding the country where each intervention was implemented, most studies were conducted in the United States (7/10), with the exception of research implemented in Spain (Espada et al., 2014), India (Sidhu et al., 2016), and the Netherlands (Schijven et al., 2020). These data are in agreement with research by Thompson et al. (2020), who, after conducting a systematic review addressing aspects related to the prevention, reduction, and treatment of alcohol and other drug use through physical activity, found that all studies linked to the preventive aspect were carried out in the United States.

In relation to the context of the intervention and the characteristics of the study participants, most of the research (7/10) was implemented in schools belonging to the secondary education stage, while the studies conducted by Collingwood et al. (1991, 2000) combined several contexts (secondary school, community centre, and health centre). It is worth noting the intervention carried out by Schijven et al. (2020), which was developed in a specialised treatment centre for people with mild intellectual disabilities and borderline intellectual functioning. All the research involved young people and adolescents, aged between 12 and 21 years old, who admitted to being users of tobacco, alcohol, cannabis, and/or other drugs prior to the intervention.

In terms of data related to economic and cultural profiles, 2/10 investigations were directed exclusively at students with lower-middle socio-economic and socio-demographic levels (Collingwood et al., 1991, 2000), as opposed to the only study, by Butzer et al. (2017), that involved individuals with a combination of these levels (upper-middle, middle, and lower-middle). On the other hand, 4/10 studies had a sample whose participants had criminal and behavioural problems (Collingwood et al., 1991, 2000; Fishbein et al., 2015; Schijven et al., 2020), while 5/10 reports did not report information on socio-economic and behavioural status in this respect.

In relation to the instruments used in the different interventions, the use of questionnaires and scales based on the assessment of the intention to use/use of substances (tobacco, alcohol, cannabis, and/or other drugs) occurred in all the studies, with the Peirs Harris Children's Self-Concept Scale (Peirs & Harris, 1969), the General Well-Being Scale (Fazio, 1977) and the Youth Risk Behavior Survey (YRBS) (Brener et al., 1995) being most commonly used to measure these variables. On the other hand, in addition to the use of instruments to measure substance use among the participants in the included sample, other instruments were implemented within the same study to assess several variables. These included (1) physical fitness being measured with the Fitnessgram Test (Cooper Institute for Aerobics Research, 1987), one of the instruments that can be used for this purpose; (2) mental health being assessed through the Perceived Stress Scale (PSS) (Cohen et al., 1983) to measure the level of stress or the Brunel Mood Scale (Terry et al., 2003) to assess the state of mind of individuals; (3) behavioural conduct being assessed through the UPPS-P Impulsive Behavior Scale (Lynam et al., 2006); or (4) emotional self-regulation being evaluated through the Scales of Self-Regulation (Wills & Ainette, 2010). It is worth mentioning that seven investigations, in full or in part, used ad hoc instruments to measure various variables in their interventions.

The results extracted from the different research studies showed that the implementation of programmes based on physical activity, physical exercise, or sports in young people and adolescents led to improvements in the prevention and even cessation of the consumption of various substances. In this regard, the study by Schijven et al. (2020) is notable, who, after conducting their intervention with Dutch adolescents, found a decrease

in the frequency of alcohol, cannabis, and/or other drug use in those participants belonging to the experimental group. In the same vein, [Mathews et al. \(2007\)](#), in addition to obtaining reductions in the use of these substances, found reductions in tobacco use, although with greater significance for females. These data are supported by the study by [Dever et al. \(2012\)](#), who, after examining the relationships between substance use in secondary school students and exercise, as well as participation in school sports, found a lower level of tobacco, alcohol, and cannabis use, which was more significant in girls with higher levels of physical exercise and sports participation.

On the other hand, in the research conducted by [Butzer et al. \(2017\)](#), in addition to obtaining a decrease in the levels of consumption of tobacco, alcohol, cannabis, and/or other drugs in those participants belonging to the experimental group, after a total of 32 sessions based on yoga exercises, improvements in emotional self-control were established. Consistent with these results are the research findings of [Bowen et al. \(2006\)](#) and [Fishbein et al. \(2015\)](#). In contrast, the research by [Werch et al. \(2005\)](#) shows a small increase in the levels of tobacco use in both the experimental and control groups.

More favourable results are provided in the studies carried out by [Sekulic et al. \(2012\)](#) and [Niedermeier et al. \(2018\)](#), who found a higher level of alcohol prevention in participants with higher levels of physical activity, with a more significant impact on the female gender. These data are in line with those of [Goldberg et al. \(2000\)](#) and [Collingwood et al. \(1991, 2000\)](#), who reported reductions related to the use of tobacco, alcohol, cannabis, and/or other drugs.

On their part, [Sun et al. \(2007\)](#) and [Espada et al. \(2014\)](#) found significant results in reducing use intention as well as tobacco use, which is consistent with the results of [Veliz et al. \(2015\)](#). [Wichstrom and Wichstrom \(2009\)](#) found that participation in sports in adolescence, as well as participation in team sports in particular, can reduce later increases in tobacco and/or cannabis use, both in later adolescence and adulthood. These data are in agreement with those reported in the research by [Sidhu et al. \(2016\)](#), who obtained a 100% smoking cessation rate in both the control and experimental groups, highlighting quite significant prevention effects through physical exercise.

On the other hand, it seems that both the number of weekly sessions given in the intervention and the duration of each session may influence the significant improvement in the results obtained. In this sense, [Collingwood et al. \(2000\)](#) carried out three weekly sessions of between 90 and 180 min, and this intervention, with the highest number of sessions and longest duration of sessions, obtained slightly more significant improvements. On the other hand, in the study carried out by [Melnyk et al. \(2013\)](#), one session per week of 20 min each was carried out, establishing itself as the research with the lowest number of weekly sessions, as well as having the shortest duration of sessions. Finally, it is worth mentioning that 3/10 reports included in this study did not have a source of funding for their research, or at least did not provide information on this aspect, while the rest of the interventions ([Collingwood et al., 1991, 2000](#); [Melnyk et al., 2013](#); [Espada et al., 2014](#); [Sidhu et al., 2016](#); [Butzer et al., 2017](#); [Schijven et al., 2020](#)) were funded by an institution for their implementation.

However, the results obtained in this systematic review should be treated with caution, as it has some limitations that should be taken into consideration. First is the complexity of evaluating the data obtained from the different variables measured in each intervention, as well as specifying these variables, which allude to the concept of “substance”, encompassing a multitude of terms corresponding to different drugs and narcotics. Another limitation relates to the differences in effectiveness based on gender and substance type, as well as to the lack of long-term follow-up.

In addition, there is a limited geographical reach, as most of the research included in this review was conducted in the United States, which may raise some doubts about the generalisability of the results to young people and adolescents in other countries. Another limitation to point out is the lack, in some of the studies included in this research, of several interesting data, such as the age of the participants (Collingwood et al., 1991, 2000; Schijven et al., 2020), as well as the mean age (and its standard deviation) of the subjects included (Collingwood et al., 1991, 2000; Goldberg et al., 2000; Fishbein et al., 2015), causing some loss of robustness with respect to the extracted findings. All this makes it very difficult to analyse and compare the different research papers.

Finally, although there was a certain level of homogeneity in the design of the research, as well as in the sample and the context in which each of the studies was carried out, the heterogeneity in the instruments used and the intervention programmes implemented means that, to a certain extent, the findings of this review should be treated with caution.

In this sense, future lines of research could be directed towards the analysis of different types of intervention formats and contexts, carrying out various combinations of interventions in order to assess the multiple positive outcomes on the health behaviours of young people and adolescents through different types of physical activity, exercise, or sports. In addition, future studies could aim to improve those evaluation processes that require follow-up data to clarify the long-term impact of the effects of physical activity on addictive behaviours, as well as to determine which type of physical activity, exercise, or sports further favours the prevention of substance use.

5. Conclusions

This work sought to conduct a systematic review of studies in which substance use prevention interventions in youth and adolescents based on physical activity, physical exercise, or sports were implemented, with the aim of answering the following research questions: Which variables (tobacco, alcohol, cannabis and/or other drugs) have been most studied when implementing such interventions? Does physical activity, exercise, or sport favour the prevention of substance use among young people and adolescents? With regard to the first question, it is possible to indicate a majority predisposition towards the study of the variable referring to tobacco use, followed by those variables referring to alcohol use and cannabis, while those referring to the use of other drugs are given to a lesser extent. On the other hand, regarding the second question, the results of the included studies reveal that interventions based on the practice of yoga, physical activity, and exercise produce significant improvements in terms of intention and reduction in substance use among the participants that took part in the intervention. Moreover, it should be noted that these improvements occur with a higher level of significance for a higher number of weekly sessions and a longer duration of sessions.

Thus, this study suggests that active treatment can have strong potential to reduce substance use. However, these findings should be taken with caution due to the limitations presented in the study.

Practical Implications

The practical applications of the systematic review relate to, on the one hand, raising awareness among researchers and academics regarding the need to conduct more research on the effects of physical activity, exercise, or sport on preventing and reducing substance use and abuse in adolescents. In addition, the findings of this review could be used to instruct and train educators and trainers involved in the prevention of/education about substance use among youth and adolescents on the importance of implementing interventions and programmes that consider the systematic and deliberate practice of physical

activity, exercise, or sport as an essential focus. In this sense, the considerations found through this research could motivate educational and social institutions to adopt measures that favour the implementation of programmes that contemplate the practice of physical activity and sport as a means of preventing and reducing the consumption of addictive substances among adolescents.

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