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Cardiovascular health education in school as the "best remedy": an integrative review

Educação em saúde cardiovascular no contexto escolar como "melhor remédio": revisão integrativa

Educación para la salud cardiovascular en el contexto escolar como "mejor medicina": una revisión integradora

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Abstract:
Objective: to identify the results of interventions developed in schools for cardiovascular health education. **Methods:** an integrative review carried out in 2024, in the following databases: Cumulative Index to Nursing and Allied Health Literature, Education Resources Information Center, Latin American and Caribbean Health Sciences Literature, Medical Literature Analysis and Retrieval System Online, Psychological Information Database, Scientific Electronic Library Online, Scopus, and Science Citation Indexes, in a timeless manner. The descriptors considered were: "Heart", "School", and "Cardiovascular diseases" in English and Portuguese. **Results:** from an initial search with 76 publications, 10 articles were considered, dating from 1996 to 2012. The strategies used for cardiovascular health education in schoolchildren were: HeartPower! Coalfields Healthy Heartbeat Project; Activity Knowledge Circuit; daily 60-minute physical activity class; Program JuvenTUM; Action Schools! and multidisciplinary educational sessions. **Conclusion:** in the applicability of the identified strategies, the results were satisfactory, strengthening the idea that health education at school should be seen as a method to mitigate the morbidity and mortality of cardiovascular diseases.
Keywords: Health promotion; Cardiovascular diseases; School health services; Child health; Health education.

Resumo:
Objetivo: identificar resultados de intervenções desenvolvidas em escolas para educação em saúde cardiovascular. **Método:** revisão integrativa realizada em 2024, nas bases: *Cumulative Index to Nursing and Allied Health Literature*, *Education Resources Information Center*, Literatura Latino-Americana e do Caribe em Ciências da Saúde, *Medical Literature Analysis and Retrieval System Online*, *Psychological Information Database, Scientific Electronic Library Online*, *Scopus* e *Science Citation Indexes*, de modo atemporal. Considerou-se os descritores: "Coração", "Escola" e "Doenças cardiovasculares" em inglês e português. **Resultados:** de uma busca inicial com 76 publicações, considerou-se 10 artigos, que datavam de 1996 a 2012. As estratégias apontadas foram: *HeartPower! Coalfields Healthy Heartbeat Project; Activity Knowledge Circuit;* aula diária de atividade física de 60 minutos; *Program JuvenTUM; Action Schools*! e sessões educacionais multiprofissional foram utilizadas para educação em saúde cardiovascular em escolares. **Conclusão**: na aplicabilidade das estratégias identificadas, os resultados demostraram-se satisfatórios, fortalecendo a ideia de que educação em saúde na escola deve ser encarada como método para mitigar a morbimortalidade das doenças cardiovasculares.
Palavras-chave: Promoção da saúde; Doenças cardiovasculares; Serviços de saúde escolar; Saúde da criança; Educação em saúde.

Resumen:
Objetivo: identificar los resultados de las intervenciones desarrolladas en las escuelas para la educación en salud cardiovascular. **Método:** revisión integradora realizada en 2024 en las siguientes bases de datos: *Cumulative Index to Nursing and Allied Health Literature, Education Resources Information Centre*, Literatura Latinoamericana y del Caribe en Ciencias de la Salud, *Medical Literature Analysis and Retrieval System Online, Psychological Information Database, Scientific Electronic Library Online, Scopus* y *Science Citation Indexes*, de forma atemporal. Los descriptores utilizados fueron: "*Coração*" (Corazón), "*Escola*" (Escuela) y "*Doenças cardiovasculares*" (Enfermedades cardiovasculares) en inglés y portugués. **Resultados:** de una búsqueda inicial de 76 publicaciones, se consideraron 10 artículos que databan de 1996 a 2012. Las estrategias identificadas fueron: *HeartPower! Coalfields Healthy Heartbeat Project*; *Activity Knowledge Circuit*; 60 minutos de clase diaria de actividad física; *Program JuvenTUM; Action Schools!* y se utilizaron sesiones educativas multiprofesionales para la educación en salud cardiovascular en estudiantes. **Conclusión**: Al aplicar las estrategias identificadas, los resultados fueron satisfactorios, lo que refuerza la idea de que la educación sanitaria en las escuelas debe considerarse un método para mitigar la morbilidad y la mortalidad de las enfermedades cardiovasculares.
Palabras clave: Promoción de la salud; Enfermedades cardiovasculares; Servicios de salud escolar; Salud infantil; Educación en salud.

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INTRODUCTION

Cardiovascular diseases (CVD) are a group of diseases of the heart and blood vessels characterized by coronary artery disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary thromboembolism, considered the leading cause of death in the world[1]. In Brazil, the prevalence of heart disease is approximately 32% of the adult population[2].

The classic risk factors for CVD are mainly hypertension, dyslipidemia, obesity, physical inactivity, smoking, diabetes and family history, among others, which include sociodemographic, ethnic, cultural, dietary, spiritual, psychosocial and behavioral characteristics[3-4].

Sociodemographic characteristics, such as sex, age, race and education, stand out in determining the risk factors for CVD[5]. There are significant costs arising from the treatment of CVD. In 2015, R$56.2 billion were spent in Brazil to cover the costs of the health system for this condition[2], which makes monitoring and implementing actions related to health education essential, with a view to promoting health and preventing heart health problems.

Developing countries may be more susceptible to the impacts of CVDs due to infrastructure deficits in essential health services and the incipient or precariousness of primary measures for health promotion and disease prevention[6-8]. Population-based approaches to preventing CVDs can positively influence the reduction of morbidity and mortality and provide people with a better quality of life[3]. Investment in educational approaches that involve and prioritize behavioral risk factors, such as inadequate diets, sedentary lifestyle, smoking and harmful alcohol consumption[1], have shown a significant effect on the prevention and control of CVDs[9], which requires the incorporation of knowledge to bring about a change in the population's attitudes[3].

The importance of health education is well-known and directly contributes to the implementation of strategies for health promotion, disease prevention, treatment and rehabilitation, as they are based on disseminating information, training and enabling critical and constructive reflections related to the causes and, mainly, establishing necessary actions to resolve them[10].

Cardiovascular health education strategies have greater potential to be successful if initiated in childhood[3,10], since the accumulation of risk factors can begin silently at this stage of life. In addition, it is recommended that approaches to cardiovascular health promotion be permeated by motivating pedagogical methods adapted to the target audience[4,6,9,11].

Not only health services, but also places that are present and active in the community, such as schools, can provide a structure for the application of educational strategies that promote the improvement of health-related behaviors[7]. Therefore, it is important to understand which interventions already exist in this area and whether they are effective in preventing CVD in order to define best practices, based on scientific evidence[3].

Given the need to understand this scenario, this study aims to identify the results of educational interventions developed in schools for cardiovascular health education.

METHODS

This is an integrative review prepared in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) strategy[12]. Four steps were determined: (1) elaboration of the research question guiding the search strategy; (2) establishment of sources for locating studies; (3) definition of inclusion and exclusion criteria; and (4) assessment of the methodological quality of the retrieved studies[13].

The research question was prepared in accordance with the PICO strategy (acronym for Patient, Intervention, Comparison, Outcomes). Thus, the following structure was considered: P - students; I - educational interventions for cardiovascular diseases; C - does not apply; O - education in cardiovascular health[14]. The following question was prepared: *What are the results of educational interventions developed in schools, with students, aiming at education in cardiovascular health?*

The bibliographic survey was carried out in May of 2024, with no defined timeframe, through virtual access to the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL); Education Resources Information Center (ERIC); Latin American and Caribbean Health Sciences Literature (LILACS), Medical Literature Analysis and Retrieval System Online (MEDLINE); Psychological Information Database (PsycINFO); Scientific Electronic Library Online (SciELO); Scopus; e Science Citation Indexes (Web of Science).

To search the databases, the descriptors present in the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) and their equivalents in Portuguese were selected, namely: “Heart”, “School” and “Cardiovascular diseases”. The keyword “Intervention” was also used. The descriptors and keywords were searched in the databases only in the title search field, within each set of terms of the PICO strategy, and then crossed with the Boolean connector AND. According to the database, specific search strategies were adopted. CINAHL, ERIC, Pubmed, Web of Science and Scopus: “Heart” AND “Intervention” AND “School” and “Cardiovascular diseases” AND “Intervention” AND “School”. LILACS and SciELO: “Heart” AND

"Intervention" AND "School" ("*Coração*" AND "*Intervenção*" AND "*Escola*") e "Cardiovascular diseases" AND "Intervention" AND "School" ("*Doenças cardiovasculares*" AND "*Intervenção*" AND "*Escola*").

The search was also conducted via the Portal for journals of the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES), using remote access through the Federated Academic Community (CAFe) by two independent researchers, simultaneously, considering the sequence of use of descriptors and keywords, cross-referencing in each database and inclusion and exclusion criteria; and then comparing the results obtained. Disagreements in the results of the searches performed were discussed and resolved through consensus between the researchers.

The selection of studies was performed through a thorough reading of titles and abstracts, so that only studies that answered the search question and met the inclusion criteria were selected. For the final selection of articles, the manuscript was read in full. Only original articles published in Portuguese, English and Spanish, with an experimental or quasi-experimental design, and a specific focus on the topic investigated were included. The following were not included: theses, dissertations, editorials, books, book chapters, review articles and letters to the editor; as well as studies published in languages other than the three established, and which did not answer the search question.

To extract the findings relevant to the object of study, a validated instrument was used[15], prioritizing the following criteria: title, authors, country of study, methodological quality, year of publication, journal, country, objective of the study, type of study, participants/sample, intervention applied, result and conclusion.

The methodological quality of the selected studies was assessed using the Scottish Intercollegiate Guidelines Network (SIGN) checklist for case-control studies[16], which presents a proposal for assessing quality clinical studies, identifying whether they are feasible, confidence in how potential biases were adequately addressed and whether the recommendations have internal and external validity, allowing the assessment of the probability of achieving the intended final results[16-17].

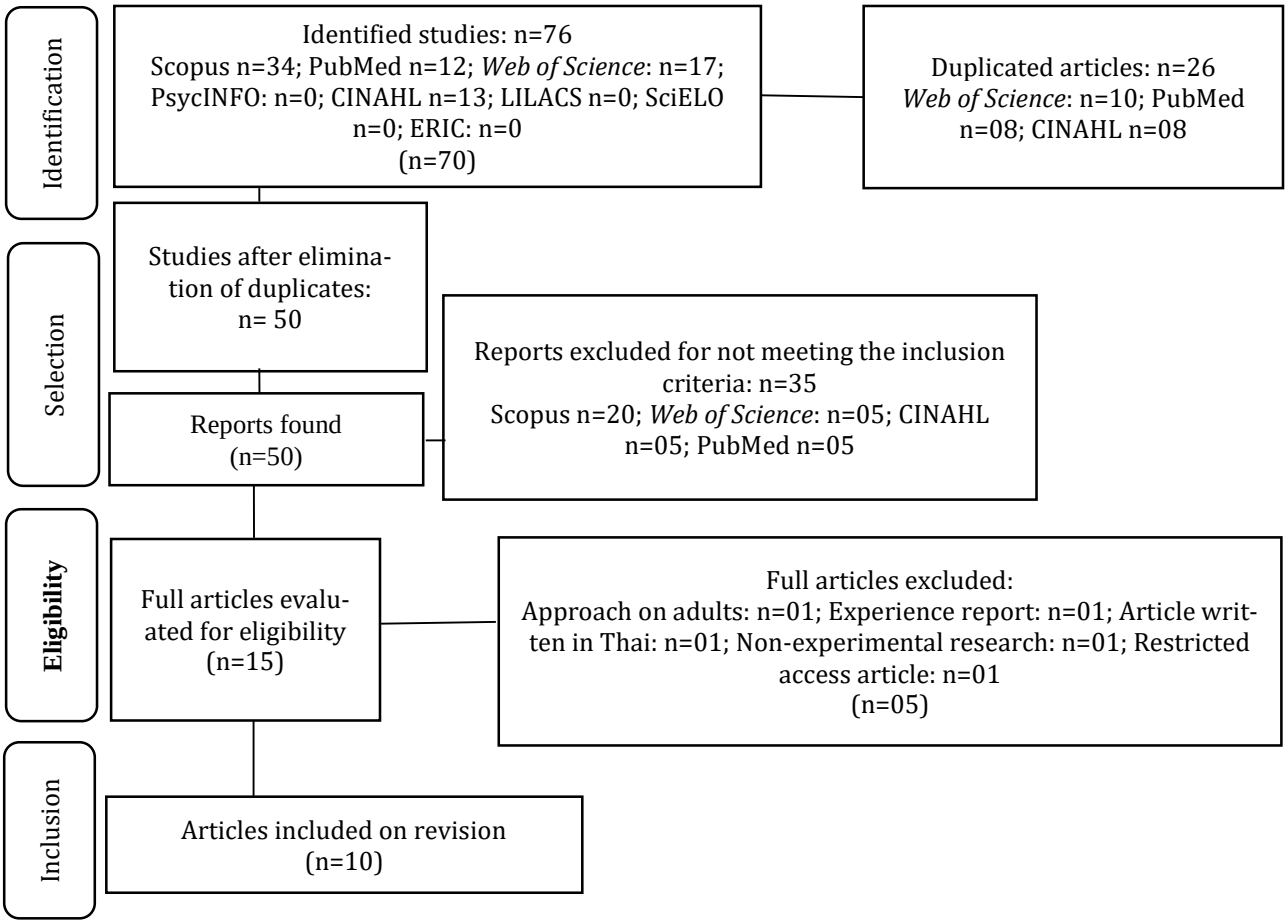
The SIGN checklist for case-control studies is structured in 11 items, each worth one point, distributed into categories: research question (one point); selection of participants (six points); measurement/evaluation of results (two points); consideration/control of confounding variables (one point); quality of the statistical analysis used (one point). The study is considered to be of high quality if most or all of the items are met; acceptable quality when

more than half of the items receive a positive score; and low quality if less than half of the items receive a positive score[16].

RESULTS

Initially, 76 studies were identified. Of these, 20 were read in full and in detail, from which 10 articles were considered, as demonstrated by the recommendations of the Preferred Reporting Items for Systematic Review and Meta-Analyses - PRISMA, in Figure 1.

Figure 1. Study selection flowchart (PRISMA). Passos, MG, Brazil, 2024.



As shown in Chart 1, the studies date from 1996 to 2012. Seven types of interventions were developed in schools to promote cardiovascular health, namely: HeartPower! Coalfields Healthy Heartbeat Project; Activity Knowledge Circuit; daily 60-minute physical activity class; JuvenTUM Program; Action Schools! and multidisciplinary educational sessions. The most frequent intervention was HeartPower! in 30% of cases.

The sample sizes varied between 58 and 1,274 students, with 60% of them consisting of more than 400 participants. The age range covered the range between seven and 14 years, with a greater concentration between nine and 11 years. Only one study exclusively addressed girls,

the others included participants of both sexes. All interventions were carried out in groups and lasted between eight weeks and four years, with 60% developed in less than 12 months (Chart 1).

Chart 1. Selected primary studies included according to: objective, strategy used, time span of intervention, sample and age of participants. Passos, MG, Brazil, 2024.

Study	Objective	Strategy used	Time span of intervention	Participants	
				Sample	Age
Knox *et al.*[18] (2012)	To investigate the response in students, related to risk factors for cardiovascular diseases, after introducing a brisk walk into curricular activities at school.	Activity Knowledge Circuit	18 weeks	182	11 to 14
Siegrist *et al.*[19] (2011)	Implement a school and family lifestyle intervention to analyze and improve cardiometabolic risk factors and vascular function.	Program JuvenTUM	4 years	700	10 to11
Resaland *et al.*[20] (2010)	To assess changes in CVD risk factors in 9-year-old children after a 2-year, 60-minute, daily school-led intervention.	Daily 60-minute PA class	2 years	259	9
Reed *et al.*[21] (2008)	To determine whether Action Schools! is an effective model for reducing CVD risk factors in primary school children.	Action Schools!	12 months	510	9 to 11
Harrell *et al.*[22] (2005)	To evaluate the effectiveness of a pilot school intervention program aimed at increasing knowledge of risk factors for CVD among fifth grade students.	Educational sessions with professionals	5 months	205	11 to 12
Nabipour *et al.*[23] (2004)	To determine whether a school-based intervention can improve knowledge about healthy hearts in third and fourth-grade children.	HeartPower!	8 weeks	1200	9 to 10
Skybo; Ryan-Wenger[24] (2002)	Compare the HeartPower! educational program with the standard health education program in schools.	HeartPower!	8 weeks	58	8 to 9
Plotnikoff; Williams; Fein[25] (1999)	To determine whether an intervention targeting school organization would have a significant effect on knowledge and attitudes toward heart health	Coalfields Healthy Heartbeat Project	12 months	657	11 to12
Harrell *et al.*[26] (1998)	To determine the immediate effects of two types of interventions in primary school in children with risk factors for multiple CVD.	HeartPower!	8 weeks	442	8 to 11
Harrell *et al.*[27] (1996)	To test a classroom intervention to reduce CVD risk factors in elementary school children.	HeartPower!	8 weeks	1274	7 to 11

Chart 2 presents the main results and conclusions of each study, summarized according to the intervention action employed.

Chart 2. Results and conclusions of selected studies. Passos, MG, Brazil, 2024.

Study	Results	Conclusion
Knox *et al.*[18] (2012)	A reduction in waist circumference was observed in the intervention group (9.8% vs. 6.9%), while this remained unchanged in the control group (10.8%). The prevalence of high SBP decreased in the intervention group (3.3% vs. 0%) and increased in the control group (1.7% vs. 5.1%). Blood cholesterol levels were significantly reduced for the intervention and control groups post-intervention. Glucose was significantly reduced for the intervention group and remained unchanged for the control group. Elevated triglycerides increased in the control group (0% vs. 7.1) and decreased in the intervention group (2.5% vs. 1.2%).	Significant difference in knowledge related to healthy lifestyle.
Siegrist *et al.*[19] (2011)	Most interventions did not improve BMI. However, in relation to physical activity, there was an increase in lean muscle mass and a decrease in fat mass without changes in BMI.	Increased lean mass, but had no influence on knowledge related to cardiovascular health, attitudes and behaviors.
Resaland *et al.*[20] (2010)	Beneficial development was identified in systolic and diastolic blood pressure, total cholesterol, triglycerides and oxygen consumption ($p<0.05$) in children in the intervention group compared to the control group. No significant differences were observed in abdominal circumference, BMI and blood glucose between the two groups.	Improved knowledge of healthy lifestyles and blood pressure and tobacco exposure.
Reed *et al.*[21] (2008)	The intervention group demonstrated a significantly greater increase in physical fitness and systolic blood pressure decreased significantly ($p<0.05$). There was no difference in diastolic blood pressure change. All serum variables in the intervention group decreased but did not reach significance.	Improvement in the CVD risk profile of children with multiple risk factors.
Harrell *et al.*[22] (2005)	Regarding the health knowledge questionnaire, a significant increase from 48±12% to 60±14% was recorded in the intervention group ($p<0.0001$); no significant change was found in the control school (43±14% to 45±14%). A significant reduction in the reported mean energy intake was observed in both groups over time ($p<0.0001$), but there was no difference between schools. No significant changes were detected in fruit consumption. Significant decrease in soft drink consumption and increase in vegetable consumption.	It has proven to be a sustainable, effective and cost-effective strategy for engaging students in physical activities on a daily basis.
Nabipour *et al.*[23] (2004)	In the intervention group, 81.4% achieved a passing score at the end of the study, while 56.4% of children in the control group ($p<0.001$). Regarding knowledge about healthy hearts, it increased from 1.43 points in the pre-test to 4.02 points in the post-test ($p<0.001$).	It could beneficially modify the CVD risk profile of children
Skybo; Ryan-Wenger[24] (2002)	Knowledge increased by an average of 1.8 points in the experimental group and 0.6 points in the control group. The experimental group achieved a passing score of 33.3%, while 12% of the children in the control group achieved a passing score of 75% at the end of the study. Cholesterol levels were relatively consistent throughout the study. In the experimental group, 21% of the children had decreased their fat intake by the end of the study. The experimental group maintained normal diastolic blood pressures throughout the study. The program showed improvement in knowledge of healthy lifestyles ($p<0.05$).	Effective in increasing children's physical activity levels at school and at home
Plotnikoff; Williams; Fein[25] (1999)	There were no statistically significant effects on knowledge scores, attitudes and self-reported behavioral measures. There were significant effects for: increased flexibility ($p<0.05$) and muscular endurance ($p<0.05$) for boys in the experimental group; and increases in aerobic endurance ($p<0.01$), flexibility ($p<0.01$), muscular strength ($p<0.05$) and muscular endurance ($p<0.01$).	Significant improvement in knowledge about heart health, eating habits, body fat percentage and blood pressure.
Harrell *et al.*[26] (1998)	Changes in cholesterol: decreased -10.1 mg/dL in the intervention group, risk group -11.7 and -2.4 in the control group. The expected increase in SBP related to growth differed between the three groups: 2.9 mmHg (intervention), 3.3 (risk group) and 5.7 (control). Changes in aerobic energy: 3.7 mg/kg/minute in the risk group, 4.4 in the intervention and 2.7 in the control. BMI and skinfolds: 0.4 in the intervention group, 6.4 in the risk group and in the control group -1.0. The total knowledge score was 64% correct in the risk group, 68% in the intervention group and 60% in the control group. In nutritional knowledge in the post-test, they were 75% for the risk group, 76% for the intervention group and 60% for the controls. Knowledge about physical activity: 43% for the risk group, 50% for the intervention group and 42% for the control group.	It positively influenced children's cardiovascular health.
Harrell *et al.*[27] (1996)	Clinically significant differences were identified between the intervention group and the control group in the change in cholesterol and diastolic blood pressure, but not statistically significant. Decreased cholesterol level (mean difference of -5.27mg). Diastolic BP increased in both groups (4.6mmHg in the intervention group and 5.7mmHg in the control). The mean self-reported physical activity scores increased by 3.73 (0.37-7.08). The prevalence of smoking was very low in both groups. The difference between the BMI change of each group was small and not significant. Total knowledge on heart health at post-test was 7.86% higher in the intervention group than in the control. Body fat was reduced in the intervention group and increased in the control group.	There was an increase in health knowledge and effectiveness in reducing the consumption of soft drinks and increasing vegetables.

All studies analyzed were randomized or non-randomized clinical trials. Half of the interventions were conducted in the United States[22-24,26-27]. In Chart 3, all studies were classified as having high methodological quality, according to the assessment performed by the SIGN checklist for case-control studies[16], with the score ranging from nine to 11 points (maximum score). The main limitations identified in the studies were the criteria for selecting participants between the groups and confounding factors (bias), which were not considered and analyzed.

Chart 3. Methodological quality of the studies considered. Passos, MG, Brazil, 2024.

Study	Question (max. 01)	Selection (max. 06)	Evaluation (max. 02)	Variables (max. 01)	Analysis (max. 01)	Total (max. 11)
Knox *et al.*[18] (2012)	1	5	2	1	1	10
Siegrist *et al.*[19] (2011)	1	6	2	1	1	11
Resaland *et al.*[20] (2010)	1	6	2	1	1	11
Reed *et al.*[21] (2008)	1	5	2	1	1	10
Harrell *et al.*[22] (2005)	1	6	2	1	1	11
Nabipour *et al.*[23] (2004)	1	6	2	1	1	11
Skybo; Ryan-Wenger[24] (2002)	1	6	2	0	0	9
Plotnikoff; Williams; Fein[25](1999)	1	6	2	0	1	10
Harrell *et al.*[26] (1998)	1	6	2	1	1	11
Harrell *et al.*[27] (1996)	1	6	2	1	1	11
Knox *et al.*[18] (2012)	1	5	2	1	1	10

DISCUSSION

The objective of this study was to identify the results of interventions developed in schools for cardiovascular health education. The scientific evidence presented is exclusively international in nature and demonstrates the need for updating, since the last study[18] that met the inclusion criteria was published in 2012, indicating the need for research on this topic.

The interventions identified addressed the practice of physical activity (100%), nutritional re-education (70%), smoking control (50%) and reduction of excessive use of social media (10%). Health education strategies were used (90%), changes in the school environment (40%) and family approach (30%). The results of the selected studies demonstrated that the interventions implemented are considered effective and capable of positively influencing knowledge and behavior change of students to promote cardiovascular health. It was observed that those responsible for implementing most of the interventions were the school teachers, after training and, during the intervention period, they were advised and/or monitored by the researchers.

Regarding physical activity, instructional sessions were applied in the classroom; brisk walks for 60 minutes performed twice a week; physical activity according to the participants' preference, with the last 15 minutes of vigorous intensity; physical activity during breaks;

moderate to intense exercises daily in order to reach 75 minutes of extra activity per week; interactive educational sessions; and a competition among students to create a poster.

The intervention with physical activity showed a reduction in abdominal circumference (9.8% vs. 6.9%) and an increase in lean muscle mass[18-19]; a significantly greater increase in physical fitness in the participants in the intervention group[21]; increased flexibility, muscular endurance and muscular strength ($p<0.05$) and improved aerobic endurance, flexibility and muscular endurance ($p<0.01$)[25]; it was shown that the values related to self-reported physical activity increased significantly, 3.73 (0.37-7.08)[27].

Regarding eating habits and body weight, there was a significant reduction in average calorie intake and a significant decrease in soft drink consumption and an increase in vegetables[22]; a reduction in fat consumption[24;] a reduction in BMI and skin folds[26]; and a reduction in body fat[27].

Regarding the blood pressure of children participating in the interventions, there was a decrease in the intervention group[18,20] and an increase in the control group[18]. Regarding blood levels of cholesterol, triglycerides, and glycemia, there were significant[18,21]; there was a beneficial development in total cholesterol and triglycerides ($p<0.05$)[20]; a reduction in cholesterol in the intervention group[26-27].

Considering the results described, it was evident that health education encouraged involvement in healthy lifestyles. For changes in the school environment, extracurricular materials were provided; training was provided for teachers; advice was given to schools on structural changes; support and ongoing monitoring by multidisciplinary professionals; review of the nutritional content of meals served in the cafeteria and vending machine options.

The family approach was carried out through guidance on physical activity, healthy eating and reduced media use; distribution of newspapers/information leaflets; training on healthy lifestyles; provision of data collected from each student to parents.

Interventions developed in schools related to the development of knowledge about the promotion of cardiovascular health recorded a significant increase from 48±12% to 60±14% in the intervention group ($p<0.0001$)[22]. Also, knowledge about cardiovascular health increased from 1.43 points in the pre-test to 4.02 points in the post-test ($p<0.001$)[23]; there was an improvement in knowledge about healthy lifestyles ($p<0.05$)[24,26]; improvement in nutritional knowledge and about physical activity in the post-test applied to the intervention group[26]; total knowledge about cardiovascular health in the post-test was 7.86% higher in the intervention group than in the control group[27].

Thus, it was possible to identify seven different interventions in the school environment, considering them effective and capable of developing knowledge about CVD, its prevention and reduction, as well as capable of causing changes in the lifestyle of children and pre-adolescents, aiming at heart health.

Considering the positive effects that physical activity provides to the overall health of the body and to the reduction of the risk of developing cardiovascular diseases, the interventions analyzed encouraged an active lifestyle by raising awareness about the importance of physical activity for health, encouraging weekly physical exercise and exercise during leisure time.

Encouraging an active lifestyle (recommended for healthy people at least 20 minutes of intense physical activity three days a week or moderate physical activity for at least 30 minutes five days a week) is important, because the beneficial effects on health produced by physical activity are unquestionable, with regard to heart health, including the reduction of total cholesterol and fractions, triglycerides, blood pressure and glycemic control[28].

Regarding nutritional reeducation, traditional and interactive classroom instructions were provided, which also included a competition among students to create a poster. An instructional session was held for participants to control smoking. Specific guidance was provided to reduce excessive use of social media.

Dietary patterns are essential information in the recommended actions for cardiovascular health. In this sense, they developed a meta-analysis to evaluate the association of food groups in relation to the protection against CVD and, afterwards, they recommended dietary patterns that combined the intake of whole grains, vegetables, fruits, nuts, dairy products and fish, associated with the reduction of the consumption of red meat, beverages with added sugar and processed and ultra-processed foods, enabling a 65% reduction in CVD[29]. Among the interventions adopted, the predominant strategy was HeartPower![23-24,26-27].

This strategy, marketed by the American Heart Association in 1996, was an educational program aimed at encouraging and identifying the effectiveness of pedagogical interventions developed in schools to promote cardiovascular health, in which children were encouraged to engage in healthy lifestyles for heart health.

An American study, a randomized clinical trial, conducted with 58 students aged eight to nine, compared the effectiveness of the HeartPower! program with traditional, expository and dialogue-based classes, aiming to improve lifestyles focused on cardiovascular health, and demonstrated that the adopted program was effective and favors the cardiovascular health of children, by reducing the consumption of fats in this population and maintaining normal diastolic pressures, in addition to increasing their knowledge on the subject[24].

A study carried out in Iran, which also used the HeartPower! program for children aged nine to ten, corroborates these results and demonstrated that this intervention is capable of significantly increasing children's levels of knowledge about healthy hearts[23].

An action research study conducted nationwide by the Universidade Federal de Santa Maria from 2011 to 2012 trained interns to implement recreational activities for schoolchildren, with the intention of positively influencing their knowledge about aspects of cardiovascular health and CVD prevention. It also highlighted the importance of implementing targeted effective interventions, both for training those who will facilitate them and for students, since addressing this issue in childhood can have a profound impact on the cardiovascular health of adults and the elderly in the future[30].

A study conducted in 2018 in six American states examined the prevalence of knowledge regarding preventive measures in cardiovascular health and showed that, among the participants, those with greater knowledge about CVD developed more preventive actions, suggesting the need for early educational interventions and investment in public programs and policies[31].

CONCLUSION

The results of ten studies were identified that confirm the satisfactory method of interventions developed in schools called HeartPower; Coalfields Healthy Heartbeat Project; Activity Knowledge Circuit; daily 60-minute physical activity class; JuvenTUM Program; Action Schools and multidisciplinary educational sessions, for the promotion of cardiovascular health in childhood, with HeartPower being the intervention most adopted by the studies.

This study brings contributions to science in health and education by identifying, analyzing and updating the existing scientific evidence on interventions developed in schools for cardiovascular health education, and by demonstrating the interventions adopted in the school context, which are the most used and their effectiveness. It also presents a perspective of methodologically evaluating the quality of the selected sample and presenting this panorama, with the intention of structuring a constructive scientific critique based on solid evidence, and providing a framework of knowledge to direct best practices in the area.

This study had as a limitation the outdated scientific evidence on the effectiveness of interventions developed in schools to promote cardiovascular health aimed at students, which made it difficult to compare this reality with more recent productions, but did not interfere with the quality and depth of the discussion, as well as the absence of certain information, or obscurities in the methodological approach of the studies.

Based on the findings, it is possible to aggregate scientific evidence capable of supporting interventions in schools to promote cardiovascular health, exposing their effectiveness, the need for new studies that update the scientific evidence in this context, and obtain structured methodological approaches that avoid possible biases and weaknesses.

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