

Effects of a physical-recreational activity program on reducing sedentary behavior indicators in middle school students

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Results: The proposed structured program of extracurricular activities led to significant changes in BMI, as demonstrated by the Wilcoxon signed-rank test (p-value = 0.02 < 0.05). The IPAQ was corroborated by the student's t-test, which showed highly significant changes after the program's implementation (p-value = 0.000 < 0.005). The Wilcoxon test for CPAF also yielded p-values of 0.00 < 0.05 for the indicators of more intense physical activity.

Conclusions: The program's implementation was effective, demonstrating highly significant results after its application in most indicators, thus confirming the research hypothesis.

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Introduction

Sedentary behavior among school-age populations is a growing public health concern. Various studies have warned that a significant proportion of children and adolescents worldwide fail to meet the recommended minimum levels of physical activity, contributing to chronic diseases, impaired physical and mental health, and the entrenchment of sedentary habits that persist into adulthood (Zhou et al., 2024; Wardle et al., 2022; Lermenda et al., 2023).

According to Montero et al. (2015) and Hernández et al. (2017), a lack of physical activity—or sedentary behavior—is directly associated with a wide range of health problems, including cardiovascular disorders and certain types of cancer such as colon cancer, as well as conditions like osteoporosis and diabetes. These authors note that sedentary behavior can be understood as a condition in which an individual does not engage in at least 30 minutes of daily physical activity for five days a week, nor performs muscle-strengthening exercises at least twice a week.

The current trend among young people toward physical inactivity and the accumulation of sedentary behaviors places them within a vulnerable population group, with a higher likelihood of developing diseases linked to these behaviors (Navarrete et al., 2019; Chávez & Sandoval, 2016). Among the factors explaining this phenomenon, the excessive use of technological resources and electronic devices stands out, as these have increased time spent in low-energy-expenditure activities (Sotomayor, Pineda, Jiménez, & Castillo, 2014), among other elements characteristic of contemporary lifestyles.

Regarding physical-recreational activities, these encompass all actions performed by individuals during their free time that generate enjoyment, emotional well-being, and contribute to the acquisition of positive values and attitudes that foster holistic development (Mateo, 2014; Andradás et al., 2015; Vázquez & Márquez, 2017).

Furthermore, the relevance of programs based on physical-recreational activities lies in their ability to adapt to the developmental characteristics and preferences of participants, allowing them to be carried out in natural or everyday environments that enhance physical, social, and intellectual growth (Chávez & Sandoval, 2014; Celis-Morales et al., 2020).

The school environment, where students spend a significant portion of their time, represents a strategic opportunity for intervention. Recent studies indicate that interventions conducted in school settings (before, during, or after school hours) can substantially modify movement habits

reducing sedentary time and promoting moderate to vigorous physical activity (Xie et al., 2025).

For example, the most recent review on correlates of physical activity and sedentary behavior during school recess—including 72 studies up to December 2024—found that structured recess interventions increase light, moderate, and vigorous physical activity in school-aged children. However, their effect on reducing sedentary time was not always significant, highlighting the need for more robust and systematic programs (Zhu et al., 2025).

Another study focusing on before- and after-school care identified multiple correlates of physical activity and sedentary behavior, emphasizing the importance of trained staff, scheduling active play, and eliminating elimination games to promote physical participation, especially among girls (Wardle et al., 2022).

Additionally, leisure-time habits—such as homework, screen time, or studying—continue to be limiting factors for physical activity, although some recent studies argue that sedentary behavior and physical activity are not always mutually exclusive. This underscores the need for comprehensive strategies to promote movement.

Regarding interventions based on theoretical models of behavior change, a recent systematic review using the transtheoretical model reported that such programs can promote positive changes in physical behavior among children and adolescents, provided they are well-designed and include motivational, educational, and follow-up components (Xie et al., 2025).

For populations with special needs—such as youth with motor coordination disorders—there is also evidence that school-based exercise programs can improve motor development, physical fitness, and foster enjoyment of movement which suggests its broad applicability (Lermanda et al., 2023).

On the other hand, the effects of prolonged sedentary behavior in school-aged children have been documented in recent longitudinal reviews, which warn that sustained sedentary behavior is associated with overweight, obesity, reduced physical abilities, and metabolic problems from an early age (Ortiz-Sánchez et al., 2023). Consequently, implementing a structured program of physical-recreational activities for middle basic education students—integrating playful, motor, social, and cognitive dimensions—emerges as a viable and necessary strategy to reverse negative trends and promote healthy lifestyles. This study aims to provide recent and localized empirical evidence, strengthening the scientific foundation for promoting school-based physical activity policies in Latin American contexts. Its objective is to evaluate the effects of a physical-recreational activity program on reducing indicators of sedentary behavior in middle basic education students.

Materials and Methods

This is an explanatory study with a quantitative cross-sectional approach and an experimental design following a single-group pre-experiment model. It was conducted at the "Profesor Jorge Amable Quezada Pinzón" Educational Unit, located in Ceiba Chica neighborhood, Zapotillo canton, Loja Province. The diagnostic phase began in May 2025. The study was experimental in nature, using a single-group pre-experimental pedagogical design with a sample of (n=42) middle basic education students.

Participants

The population of middle basic education students consisted of 42 children from the aforementioned institution during the 2025-2026 Academic Year. The sample used included (n=42) students, of which 24 were male (57.1 %) and 18 were female (42.9 %), within the morning shift.

The ages range from 9-10 years old, with a mean of 9.43 and a Standard Deviation (SD) = 0.42. The average height $M = 1.26$ meters with an $SD = 0.09$. The average body weight in kilograms was $M = 36.33$ kg with an $SD = 1.75$.

Instruments

The following techniques were used for data collection:

- **Body Mass Index (BMI) Test:** To assess body weight status and possible manifestations of obesity in children, as well as nutritional difficulties.
- **International Physical Activity Questionnaire (IPAQ):** This instrument was applied to corroborate the level and regularity of physical activity undertaken by the children. It is a questionnaire validated in several studies across Europe, Asia, and the Americas, in countries such as Spain, Great Britain, the Netherlands, the United States, among others.
- **The CPAF (Cuestionario de Actividad Física para niños),** taken from Beltrán-Carrillo et al. (2012), whose reliability and validity have been demonstrated in samples from different countries, including Great Britain and Spain, was used to measure the children's energy expenditure. It was administered at two different time points during the school year.

Procedures

The research was conducted in three stages: one for **Diagnosis of the state of activity practice and manifestations of sedentarism**, one for **Design and implementation of the physical-recreational activities program**, and one for **Evaluation of the physical-recreational activities program**. The content of each stage is described below:

- **Stage of Diagnosis of the state of activity practice and manifestations of sedentarism:** This stage began in the second week of May of the first course

period 2025-2026. During this period, the development and application of empirical research techniques and instruments were carried out, and the results were analyzed. The conclusions of the diagnosis were drawn up as a starting point for the experimentation.

Design and implementation stage of the physical-recreational activity program:

In this stage, the objectives of the program and its theoretical foundation were determined, and activities, games, exercises, etc., were established to reduce manifestations of sedentary behavior.

Evaluation stage of the physical-recreational activity program:

This was applied after the 8-week intervention during the first period of the 2025-2026 school schedule. The data from the results of each instrument were processed using the SPSS Program, version 25.0, to verify the statistical variations of the main indicators.

Ethical Considerations

The ethical principles of confidentiality, informed consent, and the voluntariness of the children's participation through their parents and guardians were respected, as well as the clinical and health criteria for the children, with information from the Student Counseling Department (DECE).

Results

To complete the Diagnosis Stage, the methods, techniques, and instruments were applied to identify the state of indicators of sedentary behavior manifestations in the sample used, through measurements of the students under study.

The BMI Test was applied to verify the nutritional status and level of obesity in the children. A scale and a measuring tape were used as materials, and compliance with some methodological criteria for its application was guided.

Below are the results obtained from the research subjects. The BMI test result (pretest) showed a mean $M=22.89$ and $SD=1.37$, with a general tendency for students to be within normal weight. However, 38.09% of the children (16) were overweight, which demonstrates a result above

the average for this age group according to the WHO and statistical data in Ecuador.

The IPAQ questionnaire was applied to the 42 children participating in the study regarding their physical activity levels, the results of which appear in the table described below:

Table 1.
Results of the International Physical Activity Questionnaire (IPAQ) in the participating children (n=42)

IPAQ Pretest						
Category	0 days	1 day	2 days	3 days	>3 days	% 2 days or more
VPA Days/Week	32	6	1	1	2	9.5%
Category	<30 Min	30-40 Min	40-45 Min	45-50 Min	>50 Min	% + 40 Min
Daily VPA Time	2	1	2	0	1	9.5%
Category	0 days	1-2 days	3 days	4 days	>4 days	% 3 or more days
MPA Days/Week	16	8	8	6	4	23.8%
Category	<30 Min	31-35 Min	35-40 Min	41-45 Min	>45 Min	% + 35 Minutes
Daily MPA Time	8	4	8	4	2	33.3%
LPA Days/Week	12	8	12	4	6	52.4%
Category	<30 Min	31-35 Min	35-40 Min	41-45 Min	>45 Min	% + 35 Minutes

Note: VPA: Vigorous Physical Activity; Daily VPA Time; MPA: Moderate physical activity; Daily MPA Time; LPA: Light Physical Activity; Daily LPA Time.

Source: Own elaboration 2025.

The results of the International Physical Activity Questionnaire (IPAQ) in the 42 children show very low levels of VPA and MPA, as well as in the time spent on daily activity. It is noteworthy that 32 of the 42 children do not engage in VPA any day of the week (76.2%) and only one child does it for more than 50 minutes. Similarly, for MPA, 16 children do not practice any day

(38.09%), which is highly noteworthy in terms of sedentary levels, and only 14 children (33.3%) practice it for more than 35 minutes per session

Regarding Light Physical Activity, which has the least physiological impact on physical condition, it is observed that 12 children (28.5%) do not engage in any practice, indicating signs of sedentary behavior among them.

Furthermore, only 22 (52.3%) practice it more than 2 days a week.

The figures point to evidence of sedentary behavior in the sampled students, which demands the need to design and implement a physical-recreational activity program that promotes increases in physical activity levels and consequently a reduction in sedentary behavior among the subjects.

The application of the CPAF to measure the children's energy expenditure was applied according to the protocol of Beltrán-Carrillo et al. (2012), allowing to obtain the energy expenditure, the time in hours for each activity, and the multiplication by the corresponding METs (metabolic unit representative of basal metabolism, equivalent to 1 Kcal/kg/h) for each category of physical work intensity (see table below).

Table 2.
METs and examples of activities for each intensity category

Intensity Cat.	METs	Examples
Sleeping	1	-----
Very Light Activities	1.5	Board games, watching TV, playing a musical instrument, reading, etc.
Light Activities	2.5	Personal hygiene, shopping, strolling, household chores, passive motor games, etc.
Moderate Activities	4	Brisk walking, dancing, cycling, going up and down stairs, chasing games, etc.
Vigorous Activities	6	Running, swimming at a normal pace, aerobics, practicing recreational sports, etc.
Very Vigorous Activities	10	Soccer match or other team sport, martial arts, training for sports like athletics, etc.

Based on the mean energy expenditure, the subjects were classified into different physical activity levels, following the classification established by literature related to an active lifestyle (Blair and Meredith, 1994; Sallis, 1993): Active (40 or more Kcal/kg/day); Moderately Active (37 - 39.99 Kcal/kg/day), Inactive (33 - 36.99 Kcal/kg/day) and Very Inactive (less than 33 Kcal/kg/day). After coding and grouping the data, the following statistical analyses were performed with the help of SPSS software version 24.

Below are the results of the CPAF questionnaire to measure calorie expenditure in the studied children:

Table 3.
Results of the estimation of time and mean energy expenditure by intensity categories during the pretest.

		Hours	Kcal/Kg/day		
INTENSITY CATEGORIES	n	Mean*	SD	Mean	SD
Sleeping	4	8.75	2.3	8.75	2.3
	2		8		8
					7
Very Light Activities	4	11.60	2.4	17.3	3.8
	2		8	9	1
					3
Light Activities	2	2.31	1.8	5.77	4.5
	8		5		3
Moderate Activities	1	0.86	1.2	3.43	5.7
	4		6		6
Vigorous Activities	4	0.33	0.6	2.00	5.2
			1		5
Very Vigorous Activities	3	0.15	0.49	1.55	4.95

Note: Values related to hours are expressed in decimal notation.

Regarding the descriptive analysis, the mean and standard deviation of the quantitative variables (time dedicated to different activities and energy expenditure) were calculated, yielding a mean of 38.89 Kcal/kg/day in average Energy Expenditure, which evaluates them as Moderately Active according to the assessment scale.

It is worth highlighting the inadequate number of subjects dedicating hours to vigorous and very vigorous activities, which demonstrates a manifestation of sedentary behavior due to the level of physical activity the subjects develop.

The children dedicated a daily average of 8.75 hours to 'sleeping'. 'Very light' activities were the most performed, occupying half the day (M=11.60 hours). For the rest of physical practices, a considerable decrease is observed in vigorous and very vigorous activities (M=0.33 hours and M=2.00 Kcal/kg/day and M=0.15 and M=1.55 Kcal/kg/day). As can be seen, as the intensity of activities increases, both the number of children who performed them and the mean dedicated to the activities and their corresponding energy expenditure decrease. The lesser time dedicated to 'moderate', 'vigorous', and 'very vigorous' activities and the scarce energy expenditure derived from them.

The design and implementation stage of the physical-recreational activity program was structured in three fundamental phases: determination of program objectives, justification and theoretical foundation, and development of activities, methods, and procedures aimed at reducing sedentary indicators in Middle Basic Education students at the educational institution.

Phase 1. Determination of the program objectives

In this phase, the objectives that guided the design and execution of the physical-recreational activity program were established, taking as reference the results obtained in the diagnostic stage and the biopsychosocial characteristics of the Middle Basic Education students.

General Objective

Reduce sedentary indicators in Middle Basic Education students through the systematic application of a physical-recreational activity program, favoring the adoption of active and healthy habits.

Specific Objectives

- Increase the daily physical activity level of students through planned recreational activities.
- Reduce time allocated to sedentary behaviors, such as prolonged use of electronic devices.
- Foster active participation and interest in the regular practice of physical activity.
- Develop basic physical capacities through games and recreational dynamics.
- Promote active lifestyle habits that contribute to the physical and emotional well-being of students.

Phase 2. Justification and foundation of the program

Sedentary behavior constitutes one of the main health problems in the school-age population, directly affecting the physical, emotional, and social development of students. In the Middle Basic Education stage, the increase in time dedicated to passive activities, such as the use of electronic devices and the decrease in physical activity practice, favors the appearance of problems such as overweight, poor physical condition, and demotivation towards exercise.

Given this problem, the design and implementation of a physical-recreational activity program is justified, allowing the reduction of sedentary indicators through playful, motivating strategies adapted to the students' age. The program seeks to generate a dynamic and participatory environment that incentivizes movement, strengthens school coexistence, and promotes active and healthy lifestyles.

Theoretical Foundation

Physical-recreational activity in school contexts has been identified as a key element to reduce sedentary behaviors and promote healthy lifestyles in adolescents.

Studies show that these interventions not only increase physical activity but also favor motivation, social interaction, and the willingness to actively participate in group experiences (Quimuña, 2025). Furthermore, structured physical exercise programs have been shown to decrease sedentary indicators and improve physical and emotional health parameters in youth (Silva Filho et al., 2023). Systematic reviews show a positive relationship between high levels of physical activity and better health perception, while sedentary behavior is associated with negative outcomes in children and adolescents. Finally, physical-school interventions contribute not only to physical activity itself but also to mental well-being and school engagement (Lubans et al., 2020).

Phase 3. Development of activities, methods, and procedures for reducing sedentary behavior

In this phase, the activities, methods, and procedures that made up the physical-recreational activity program were designed. Activities were selected considering the age, motor development level, and preferences of the students, prioritizing the playful, inclusive, and participatory nature over 8 weeks with a frequency of three days per week and a duration of 45 minutes.

The program included dynamic games, motor circuits, recreational aerobic activities, and cooperative games, organized progressively and structured. Active and participatory methods were employed, such as the playful method and cooperative learning, favoring the constant involvement of students and reducing inactivity time during sessions.

Methodological procedures included structured sessions with warm-up, main part, and cool-down phases, ensuring safety and adequate control of activity intensity. Likewise, evaluation and follow-up criteria were established to assess participation, physical activity level, and reduction of sedentary indicators.

See activities below:

Table 4.
Methodological structure of each session

Phase	Time	Activities
Warm-up	10 min	Dynamic games, joint mobility, cardiovascular activation
Main part	30 min	Planned physical-recreational activities
Cool-down	5 min	Stretching, breathing, relaxation

Proposed Exercises (per session): General Warm-up: Methodological guidelines

Included exercises are: Neck Rotations: worked in the cervical zone; consists of slowly rotating the head in wide circles, either seated or standing. 3 turns per side are performed. It is essential to maintain an upright posture and avoid dizziness.

Shoulder Circles: directed at the shoulders; rotations forward and backward, 10 repetitions per direction. Breathing should be controlled, avoid shrugging the shoulders, and ensure smooth movement.

Wrist Rotations: for the wrists; gentle rotations with both hands for 15 seconds per direction, ensuring elbows remain close to the body to isolate the wrist joint and avoid unnecessary tension.

Hip Flexion-Extension: action on hips; lift knee to chest and then extend backward, 10 repetitions per leg. Should be done with fluid movement, without bouncing, maintaining control to not generate brusque forces on the hip or lumbar joint.

Ankle Mobility: focused on ankles; drawing circles with the foot in the air, 10 repetitions per foot, avoiding tensing the supporting leg, keeping it relaxed.

Hamstring Stretch (standing): involving legs; lean forward keeping knees slightly bent, 3 repetitions of 20 seconds each. It is important not to force the flexion, keep the back as straight as possible to avoid lumbar tension.

Lateral Trunk Stretch: acting on the trunk; lean to each side with arm raised, 3 repetitions of 20 seconds per side. Lifting the feet or tensing the neck should be avoided, concentrating on controlled lateral leaning.

Deep Breathing + Resting Posture: general exercise for all musculatures; at the end, sit or lie down and perform deep breaths for 3 minutes, observing general body relaxation, allowing muscles to relax before starting the main part of the training.

Table 5.

Weekly activities (repeated progressively over 8 weeks)

Monday – Dynamic games and coordination

Phase	Activity	Methodology	Materials	Worked-on Indicators
Warm-up	Game "Catch the Colors"	Playful, participatory	Cones, cards	Motor activation
Main part	Coordination circuit (jumps, zigzag, throws)	Station work	Hoops, balls, ropes	Reduction of sedentary time
Main part	Collective game "Pass and Run"	Cooperative	Ball	Active participation
Cool-down	Guided stretches	Directed	None	Recovery

Table 6.

Wednesday activities – Recreational aerobic activities

Phase	Activity	Methodology	Materials	Worked-on Indicators
Warm-up	Joint mobility with music	Rhythmic	Speaker	Activation
Main part	Chasing games	Playful	Cones	Reduction of inactivity
Main part	Relay races	Healthy competition	Batons	Increase in energy expenditure
Cool-down	Breathing and stretching	Guided	None	Relaxation

Table 7.

Friday – Recreational games and teamwork

Phase	Activity	Methodology	Materials	Worked-on Indicators
Warm-up	Game "Simon Says"	Playful	None	Active attention
Main part	Mini-sports games (soccer, dodgeball)	Adapted	Balls	Reduction of sedentary behavior
Main part	Cooperative games	Collaborative	Hoops	Social integration
Cool-down	Body relaxation	Directed	Mats	Well-being

Weekly analysis and interpretation of the program

The weekly table of the physical-recreational activity program shows a balanced and progressive planning, aimed at reducing sedentary indicators in Middle Basic Education students. The distribution of activities throughout the week integrates dynamic games, aerobic exercises, and cooperative activities, which favors active and sustained participation. The use of playful and participatory methodologies increases motivation and reduces physical inactivity time. Furthermore, the inclusion of warm-up and cool-down phases guarantees safe and organized practice. The indicators worked on reflect an increase in energy expenditure and greater motor activation. Together, the proposal contributes to the development of active habits, improves school coexistence, and promotes the physical and social well-being of students. The following progression by weeks is proposed: Weeks 1-2 (Low Intensity - Adaptation and motivation), Weeks 3-4 (Medium Intensity - Increase in active time), Weeks 5-6 (Medium-High Intensity - Greater motor complexity) and Weeks 7-8 (High Intensity - Consolidation of active habits).

Análisis e interpretación

The program's progression by weeks shows a gradual and systematic structure that favors the students' progressive adaptation to physical activity.

During weeks 1 and 2, the low intensity allowed for adequate motor and motivational adaptation, reducing the risk of fatigue or dropout. In weeks 3 and 4, the increase to medium intensity favored an increase in active time and sustained participation. Subsequently, in weeks 5 and 6, the medium-high intensity incorporated greater motor complexity, stimulating the development of physical skills and the reduction of sedentary behavior. Finally, in weeks 7 and 8, the high intensity contributed to the consolidation of active habits, strengthening adherence to the regular practice of physical activity and promoting healthy lifestyles.

The evaluation stage of the effectiveness of the physical-recreational activity program aimed to verify the effectiveness of the program's application using descriptive and inferential statistical variables to test the research hypothesis. In this phase, posttest tests were applied to the children, the results of which are described below.

The results of the BMI Test show favorable results in the anthropometric indicators of the evaluated children, demonstrating changes in their lifestyle after the program's application. The mean result was $M=22.57$, indicating that besides remaining at normal weight, there is a general decrease among all children. As a significant fact, from a total of 16 overweight children in the pretest, only 8 were diagnosed in the posttest.

sobrepeso en el pretest, solo se diagnosticaron 8 en el posttest.

To corroborate effectiveness, the Shapiro-Wilk normality test was applied to the results of this test, which showed that the BMI data for the pretest and posttest yield a Sig. level of $p=0.21$ (pretest) and 0.56 (posttest), in both cases greater than 0.05 , assuming the data do not have a normal distribution. Therefore, the Wilcoxon signed-rank test was applied, which yielded the following results: $P=0.02 < 0.05$, so there are differences between the BMI before and the BMI after applying the proposed program.

Regarding the International Physical Activity Questionnaire (IPAQ) in the 42 children during the posttest after applying the program, changes are observed in each of the activity type variables by intensity of participation per days of the week. Concerning VPA, 28 children (67% of the sample) practice exercises of this intensity at least twice a week, which demonstrates a significant change related to the pretest.

For MPA, 71.4% (30 children) practice at this intensity level at least twice a week, showing commendable progress in the use of free time for moderate physical activities compared to the pretest and a decrease in sedentary indicators.

Regarding Light Physical Activity, only 13 children (39.4%) practice it at least twice a week, demonstrating a more massive incorporation into moderate and vigorous activities after applying the proposal. To corroborate the researcher's hypothesis, the data were subjected to the Shapiro-Wilk normality test, which showed that the data have a distribution with p -value results > 0.05 . Therefore, effectiveness was corroborated using the parametric Student's t -test, which showed that in the three variables (VPA, MPA, and LPA) there were highly significant changes after applying the proposal with $p=0.000 < 0.005$, as can be seen in the following table:

Table 8.

Results of the Student's t hypothesis test for physical activity intensity levels by days per week

Variable	Paired Differences			
	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
VPA Days/Week Pretest - VPA Days/Week Posttest	22.1048	3.5538	0.5484	0.000
MPA Days/Week Pretest - MPA Days/Week Posttest	-0.690	0.680	0.105	0.000
LPA Days/Week Pretest - LPA Days/Week Posttest	2.167	1.724	0.374	0.000

As a result of the CPAF Questionnaire posttest to measure energy expenditure, the following result was obtained, which contrasts with the pretest:

Table 9.
Results of the CPAF Questionnaire during pretest and posttest

Pretest Caloric Expenditure				Posttest Caloric Expenditure			
INTENSITY CATEGORIES	n	Mean	SD	INTENSITY CATEGORIES	n	Mean	SD
Sleeping	42	8.75	2.38	Sleeping	42	8.70	2.37
Very light activities	42	11.6	2.48	Very light activities	42	10.83	2.35
Light activities	28	2.31	1.85	Light activities	42	0.48	1.25
Moderate activities	14	0.86	1.26	Moderate activities	21	1.95	1.26
Vigorous activities	4	0.33	0.61	Vigorous activities	11	1.45	0.63
Very vigorous activities	3	0.15	0.49	Very vigorous activities	3	0.58	0.69
TOTAL		24		TOTAL		24	48.50

The results show easily perceptible differences during the posttest compared to the pretest in Caloric Expenditure for Physical Activity, especially in activities of greater physical work intensity. In this sense, the increase in energy expenditure in activities such as moderate, vigorous, and very vigorous activities is easily perceptible, suggesting a greater tendency to practice physical activities during free time and a decrease in sedentary indicators. The final result of calories expended increased to 48.50

kcal/kg/day, which classifies them as Very active. These results were subjected to the Shapiro-Wilk normality test, which showed a P-value < 0.05 for all indicators. The null hypothesis (H_0) was accepted, assuming that the data do not follow a normal distribution. Therefore, a non-parametric hypothesis test was applied—specifically, the Wilcoxon signed-rank test. The results are shown below:

Table 10.
Results of the Wilcoxon Test on Caloric Expenditure by Physical Activity Levels During the Pretest and Posttest

	Sleep_caloric_expenditure_posttest - Sleep_caloric_expenditure_pretest	Light_activities_caloric_expenditure_posttest - Light_activities_caloric_expenditure_pretest	Caloric Expenditure in Light Activities Posttest - Caloric Expenditure in Light Activities Pretest	Caloric Expenditure in Moderate Activities Posttest - Caloric Expenditure in Moderate Activities Pretest	Caloric Expenditure in Vigorous Activities Posttest - Caloric Expenditure in Vigorous Activities Pretest	Caloric Expenditure in Very Vigorous Activities Posttest - Caloric Expenditure in Very Vigorous Activities Pretest
Z	-0.640b	-1.823b	-5.547b	-4.414c	-3.962c	-3.681c
Sig.	0.522	0.068	0.00	0.00	0.00	0.00
Wilcoxon signed-rank test						

These results indicate that there were highly significant changes in the following indicators: Caloric expenditure in light activities, Caloric expenditure in moderate activities, Caloric expenditure in vigorous activities, and Caloric expenditure in very vigorous activities, with results of $P\text{-value} = 0.00 < 0.05$. This demonstrates a greater number of hours and average energy expenditure in the post-test for high-energy-expenditure activities compared to the pre-test.

However, for activities with lower energy expenditure (Caloric expenditure while sleeping and Caloric expenditure in very light activities, with $P\text{-values} = 0.522$ and $0.068 > 0.05$), there were no differences in the consumption and hours dedicated to low-intensity activities among the studied subjects. This corroborates the researcher's hypothesis (H_1), which posits that there were significant differences in caloric expenditure (Kcal/kg/day) after the implementation of the proposal among the studied subjects, and consequently, greater participation in physical activities and a reduction in sedentary behavior.

Discussion

The results of the present study demonstrate that the implementation of a structured physical-recreational activity program over eight weeks had a positive and statistically significant impact on reducing indicators of sedentary behavior in Middle Basic Education students. The observed improvements in Body Mass Index (BMI), the increase in moderate and vigorous physical activity (IPAQ), and the rise in daily energy expenditure (CPAF) confirm the effectiveness of the intervention.

These findings align with those reported by Lubans et al. (2020), who demonstrated that school-based recreational physical activity interventions not only increase students' active time but also generate benefits for physical health and emotional well-being. In both studies, the use of playful and participatory strategies proved key to increasing adherence and reducing time spent in sedentary behaviors.

Similarly, Celis-Morales et al. (2020) reported that systematic school programs can lead to significant reductions in sedentary behavior and improve anthropometric indicators in children and adolescents, which supports the changes observed in BMI in the present study. Here, the number of students with overweight was halved following the intervention.

The results related to the increase in energy expenditure and the transition from a "moderately active" to a "very active" level concur with the observations of Silva Filho et al. (2023). They evidenced that well-structured recreational programs promote a sustained increase in daily caloric expenditure and greater participation in moderate- and vigorous-intensity activities, which are determining factors in preventing childhood sedentary behavior.

Furthermore, the significant changes observed in vigorous and moderate physical activity coincide with the findings of Xie et al. (2025). Based on a systematic review, they concluded that school interventions based on behavioral change models and progressive follow-up generate substantial improvements in children's physical activity patterns. In the present study, the weekly progression of the program appears to have favored this behavioral adaptation.

On the other hand, Zhu et al. (2025) pointed out that while many interventions increase physical activity during school hours, they do not always manage to consistently reduce sedentary behavior outside this context. Nevertheless, the results of the present work show that the program positively influenced the students' free time, as evidenced by the increased energy expenditure in vigorous and very vigorous activities. This suggests a transfer of active habits beyond the classroom.

From a public health perspective, the findings align with those noted by Ortiz-Sánchez et al. (2023), who warned that prolonged sedentary behavior in early ages is associated with overweight, obesity, and metabolic disorders. In this sense, the reduction in sedentary indicators observed in the study reinforces the need to implement sustained, preventive school-based programs.

Collectively, the comparative evidence demonstrates that the results obtained are not isolated but rather integrate into a scientific trend that supports school-based intervention through physical-recreational activities as an effective, viable, and high-impact strategy to combat sedentary behavior in children, particularly in Latin American contexts where such programs remain limited.

Conclusions

The quantitative results demonstrated that implementing the physical-recreational activity program over eight weeks produced statistically significant changes in sedentary indicators. These changes were reflected in a reduction of the Body Mass Index (BMI) from an average of 22.89 to 22.57, a decrease in the number of students with overweight from 16 to 8, an increase in the practice of moderate and vigorous physical activity reaching at least two days per week in 71.4% and 67% of participants, respectively, and an increase in daily energy expenditure from 38.89 to 48.50 Kcal/kg/day, classifying the sample as "very active" ($p < 0.05$).

From the qualitative perspective, greater motivation, sustained participation, enjoyment of the activities, and a positive attitude toward regular physical exercise were observed. The integration of both approaches confirms that the program not only generated objective improvements in physical fitness but also favorable changes in students' active habits and behaviors.

It thus establishes itself as an effective, replicable, and high-impact school-based intervention for reducing sedentary behavior and promoting healthy lifestyles.

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Conflict of Interest Statement

The author declares no conflicts of interest related to the execution of this research.