

Impact of sedentary behavior on the academic performance of fifth-grade students: a comparative study

Impacto del sedentarismo en el rendimiento académico de estudiantes de quinto grado: un estudio comparativo

Henry Leonardo González Sánchez

Universidad Técnica Particular de Loja, Ecuador (hlgonzalez@utpl.edu.ec) (<https://orcid.org/0009-00019707-6348>)

Amady Lourdes Armijos Tandazo

Universidad Técnica Particular de Loja, Ecuador (alarmijos@utpl.edu.ec) (<https://orcid.org/0009-0000-5632-2728>)

Geovanny Patricio Cárdenas Caicedo

Universidad Técnica Particular de Loja, Ecuador (gpcardenas6@utpl.edu.ec) (<https://orcid.org/0009-0009-3496-7467>)

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ABSTRACT

Keywords:

sedentary behavior, academic performance, physical activity, primary education.

In Ecuador, the National Institute of Statistics and Censuses (INEC) reveals that, in 2018, close to 35% of children between 5 and 11 years old presented with overweight or obesity, a trend that is directly associated with the excessive use of electronic devices and prolonged permanence in sedentary positions. These passive habits both within the home and school have been identified as contributing factors to childhood sedentarism. The present study aims to analyze the relationship between sedentarism and academic performance in fifth-grade students of the "Unidad Educativa Fiscomisional La Inmaculada," using a quantitative approach, a descriptive-comparative, and cross-sectional design. The independent variable is the level of sedentarism, measured using the Pictorial Child Physical Activity Questionnaire (C-PAFI), validated with content, construct, and criterion evidence. The dependent variable corresponds to academic performance, determined from institutional grades. The results show that, although no statistically significant differences were found in academic performance based on the level of physical activity, students with higher levels of physical activity showed tendencies toward better academic averages. The ANOVA analysis showed non-significant differences between the groups ($F = 2.62$, $p = 0.078$), suggesting that in this study, the level of physical activity does not have a significant impact on academic performance. These findings underscore the need to implement more consistent institutional actions to promote physical activity in the school environment and to explore the relationship between sedentarism and academic performance in longitudinal studies.

RESUMEN

Palabras clave:

sedentarismo, rendimiento académico, actividad física, educación básica.

En Ecuador, el Instituto Nacional de Estadística y Censos (INEC) revela que, en 2018, cerca del 35% de los niños de entre 5 y 11 años presentaban sobrepeso u obesidad, una tendencia que se asocia directamente con el uso excesivo de dispositivos electrónicos y la permanencia prolongada en posiciones sedentarias. Estos hábitos pasivos dentro del hogar y la escuela han sido identificados como factores contribuyentes al sedentarismo infantil.

El presente estudio tiene como objetivo analizar la relación entre sedentarismo y rendimiento académico en estudiantes de quinto grado de la "Unidad Educativa Fiscomisional La Inmaculada", utilizando un enfoque cuantitativo, diseño descriptivo-comparativo y de corte transversal. La variable independiente es el nivel de sedentarismo, medido mediante el Cuestionario Pictórico de Actividad Física Infantil (C-PAFI), validado con evidencia de contenido, constructo y criterio. La variable dependiente corresponde al rendimiento académico, determinado a partir de calificaciones institucionales. Los resultados muestran que, aunque no se encontraron diferencias estadísticamente significativas en el rendimiento académico según el nivel de actividad física, los estudiantes con niveles más altos de actividad física mostraron tendencias hacia mejores promedios académicos. El análisis ANOVA mostró diferencias no significativas entre los grupos ($F = 2.62, p = 0.078$), lo cual sugiere que, en este estudio, el nivel de actividad física no tiene un impacto significativo en el rendimiento académico. Estos hallazgos subrayan la necesidad de implementar acciones institucionales más consistentes para promover la actividad física en el entorno escolar y explorar la relación entre el sedentarismo y el rendimiento académico en estudios longitudinales.

Introduction

Physical inactivity among children has emerged as a public health issue of growing concern, significantly affecting the physical, cognitive, emotional, and academic development of school-age children. The World Health Organization (WHO, 2023) reports that more than 80% of adolescents worldwide do not meet the minimum recommendations for physical activity, a situation that has been exacerbated by the proliferation of sedentary leisure activities and family environments that do not promote regular physical activity (Méndez, 2019), a lack of physical activity during childhood not only limits the acquisition of fundamental motor skills and affects fine and gross motor coordination, but also impacts cognitive development, including critical processes such as attention, memory, planning, and problem-solving—all of which are essential for adequate academic performance (Wahyuni et al., 2024).

In Ecuador, the National Institute of Statistics and Censuses (INEC, 2021) reports that, in 2018, nearly 35% of children aged 5 to 11 were overweight or obese—a trend directly linked to excessive use of electronic devices and prolonged periods of sedentary behavior. These passive habits at home and at school have been identified as contributing factors to childhood physical inactivity (Medina et al., 2024). Recent research has shown that a sedentary lifestyle in children is associated with lower academic motivation, difficulty concentrating, and poorer school performance compared to children who engage in regular physical activity (Medina et al., 2024).

A sedentary lifestyle is defined as minimal physical activity, which results in low energy expenditure by the human body, thereby limiting a child's overall development and increasing the risk of chronic noncommunicable diseases, such as childhood obesity and cardiovascular problems (Olarde et al., 2021; Cruz, 2021). On the contrary, gross motor skills—which comprise a set of physical abilities essential for functional movement and the development of motor skills necessary for sports and recreational activities—are a fundamental pillar of a child's healthy development (Cordellat, 2025), the contrast between a sedentary lifestyle and gross motor skills highlights that inactivity limits a child's bodily experience and reduces their ability to interact with their environment in an effective and meaningful way; this interaction is crucial for a child's holistic development, and its absence can have negative consequences on academic performance and overall health.

Various studies show that schools play a decisive role in promoting or mitigating sedentary behavior among children. According to Riquelme (2025), in a national survey on physical activity and sports, 56.9% of children and adolescents aged 5 to 17 have an inactive lifestyle, while in school settings this percentage reaches as high as 95%, indicating that most of their time is spent on sedentary activities that do not meet the 60 minutes per day recommended by the WHO. This shows that schools can become promoters of sedentary habits if they do not implement educational strategies that encourage movement and physical activity. Systematic longitudinal studies, such as those conducted by Ortiz-Sánchez et al. (2021) reveal that as children get older, the time they spend on physical activity decreases and the prevalence of overweight and obesity increases, confirming the need to intervene during the school years to establish healthy habits from an early age.

Factors such as prolonged screen time, a lack of safe spaces for physical activity, and limited family support contribute to the rise in sedentary lifestyles among children. The GASOL Foundation (2025) reports that children have spent up to 11 additional hours per week using digital devices since 2019, and the University of Canterbury (El País, 2025)

indicates that young children spend more than 90 minutes a day in front of screens, which is correlated with poorer social skills and a higher risk of obesity. In addition, the urban environment and infrastructure play an important role; neighborhoods with poor pedestrian accessibility, a lack of parks, or unsafe road conditions reduce opportunities for physical activity, while pedestrian-friendly urban environments with adequate infrastructure significantly reduce levels of physical inactivity (Cordellat, 2025). These findings show that physical inactivity among children is a multifactorial phenomenon influenced by technological, environmental, family, and structural factors, requiring coordinated interventions at school, at home, and in urban planning.

The impact of a sedentary lifestyle on children is not limited to physical aspects. Zhang et al. (2022) found in a systematic review that high levels of physical inactivity are associated with increased symptoms of depression and anxiety and reduced psychological well-being in children and adolescents. Therefore, prolonged inactivity has a negative impact on a child's overall development, affecting physical, cognitive, emotional, and social aspects. The WHO (2020) recommends at least 60 minutes of moderate- to vigorous-intensity physical activity per day; however, in Ecuador, nearly 88% of children and adolescents aged 5 to 17 do not meet this recommendation, increasing their risk of developing heart disease, diabetes, hypertension, and mental health problems (Alvarado Alvarado et al., 2023).

In this context, physical education emerges as a key tool for combating a sedentary lifestyle in schools; this subject not only ensures that time is devoted to physical activity but also contributes to psychomotor development, coordination, self-confidence, and self-care (Velázquez Callado, 2018; Montil et al., 2005). Physical education promotes healthy lifestyle habits, strengthens motor and cognitive skills, and enables children to develop emotional and social competencies that have a positive impact on their academic performance. Recent studies show that regular physical activity improves memory, attention, and spatial orientation, contributing to students' holistic development (Aznar and Vernet, 2022).

Academic performance, for its part, is a comprehensive indicator of student learning and development. Ariza et al. (2018) conceptualize academic performance as the relationship between the resources contributed by the student—such as personality, motivation, aptitudes, and interests—and the level of achievement attained. Martínez et al. (1996) defines academic performance as the result of achievements in educational institutions, expressed primarily through grades, but this definition is limited if it does not take into account the interaction of cognitive and noncognitive factors, which include intelligence, memory, self-regulation, academic self-esteem, and emotional stability (Alj and Bouayad, 2024).

Similarly, social and family factors have a significant influence on academic performance. Vygotsky (1978) notes that cognitive development arises from social interaction, and studies by Davis-Kean (2005) show that parents' educational level is associated with better academic performance; active parental involvement, emotional support, and the creation of stimulating learning environments enhance children's learning and motivation (Fan and Chen, 2001). At the school level, teacher quality, teaching strategies, classroom climate, and the use of educational resources have a direct impact on academic performance (Piaget, 1952; Gillies, 2016; Puente-Maxera et al., 2019).

Taking these considerations into account, the objective of this study is to analyze the relationship between a sedentary lifestyle and academic performance among fifth-grade students at the "Unidad Educativa Fiscomisional La Inmaculada," using a quantitative approach and a descriptive-comparative, cross-sectional design. The

independent variable is the level of physical inactivity, measured using the Pictorial Questionnaire on Children's Physical Activity (C-PAFI), which has been validated through content, construct, and criterion evidence (Morera-Castro et al., 2018), while the dependent variable is academic performance, determined based on school grades. This approach highlights how physical and lifestyle factors influence academic performance, providing relevant information for designing pedagogical strategies and educational policies aimed at the holistic development of students (Silva et al., 2018; Ortiz et al., 2024).

The document is divided into four chapters: the first presents the theoretical and conceptual framework; the second describes the methodology used; the third presents the results and their analysis; and the fourth offers conclusions and recommendations. This study contributes to generating local evidence on the relationship between a sedentary lifestyle and academic performance, providing a foundation for educational and community interventions that promote active, healthy lifestyles and foster children's holistic development starting in school, while involving families in this formative stage (Cruz, 2021).

Method

Population and Sample

The study population consists of students in General Basic Education at the "La Inmaculada Fiscomisional Educational Unit," located in the city of Loja, Ecuador. For this study, fifth-grade students in General Basic Education (EGB) were specifically selected, given that they are at a critical stage of physical and academic development and are suitable for the assessment tool used (C-PAFI), which is designed for children between the ages of 9 and 13 (Morera-Castro et al., 2018).

The sample was selected using non-probabilistic convenience sampling, based on direct access to students in the specified grade. This study is justified by the homogeneous characteristics of the group, which facilitate meaningful comparisons of sedentary behavior and academic performance; the study population consisted of 103 individuals.

Study Context

The research was conducted at the "La Inmaculada" Fiscomisional Educational Unit (UELI), a religiously oriented fiscomisional institution located in downtown Loja, Ecuador. This institution provides basic facilities for physical activity, a full academic program, and access to technologies that can influence students' lifestyles. The study focused on examining how a sedentary lifestyle affects the real, day-to-day educational environment at this institution.

Epistemological Positioning

This research falls within the empirical-analytical paradigm, grounded in the positivist tradition.

Research Focus

The study takes a quantitative approach, characterized by the collection of numerical data in order to test hypotheses through measurement and statistical analysis.

This approach makes it possible to identify behavioral patterns and validate theories objectively.

Research Design

This study employs a descriptive-comparative design with a cross-sectional time frame. The descriptive design aims to characterize students' current conditions in terms of their level of physical inactivity and academic performance, while the comparative design identifies significant differences among the various levels of physical activity observed (Alban et al., 2020). Cross-sectional studies allow for the simultaneous measurement of both exposure (level of physical inactivity) and outcome (academic performance), making them an effective tool for estimating the prevalence of a condition in a given population and identifying observable associations without determining the direction of causality between variables (Cvetkovic-Vega et al., 2021).

Methodological Strategy

The methodological strategy employed is the case study, focusing on a specific unit of analysis within a clearly defined educational context: fifth-year students in Basic General Education at the "La Inmaculada" Fiscomisional Educational Unit. This method is useful for understanding phenomena in their real-world context, especially when the boundaries between the phenomenon and its context are not entirely clear (Orlando López González, 2013).

Although traditionally associated with qualitative approaches, this method can also be implemented from a quantitative perspective, especially when it focuses on measuring specific variables using validated instruments and statistical techniques.

Data Collection Techniques and Tools

For the independent variable (level of physical inactivity), the Pictorial Questionnaire on Children's Physical Activity (C-PAFI) was used, a validated tool designed for school-aged children aged 9 to 13. This tool allows students to be classified into physical activity levels (sedentary, somewhat active, active, and very active) using illustrated items with visual, easy-to-understand response options. The C-PAFI has content, construct, and criterion validity, as well as acceptable internal consistency ($\alpha = 0.637$) and moderate intraclass correlation ($ICC = 0.741$), according to the validation study conducted by Morera-Castro et al. (2018).

To evaluate academic performance, the average grades in the subjects of mathematics, language and literature, natural sciences, and social studies were taken into account. These subjects were selected because they constitute core areas of the mandatory national curriculum and are included in the standardized assessments administered by the National Institute for Educational Assessment (INEVAL) (2022), such as the "Ser Estudiante" program, which is designed to measure learning achievement in fundamental competencies within the Ecuadorian education system.

Results

This section presents the results obtained regarding the levels of physical inactivity among fifth-grade students at La Inmaculada School, their academic performance, and the statistical analysis used to determine the relationship between these two variables. Pie charts are used to visualize the distribution of sedentary behavior by parallel group, tables showing academic averages by physical activity level, and an ANOVA test to compare the groups. To ensure confidentiality and facilitate data management, the students' names have been replaced with unique alphanumeric codes. This measure is in line with the principle of respect for privacy and the ethical use of information in school settings.

FIGURE 1

Distribution of Physical Inactivity Levels Among Students in Class A

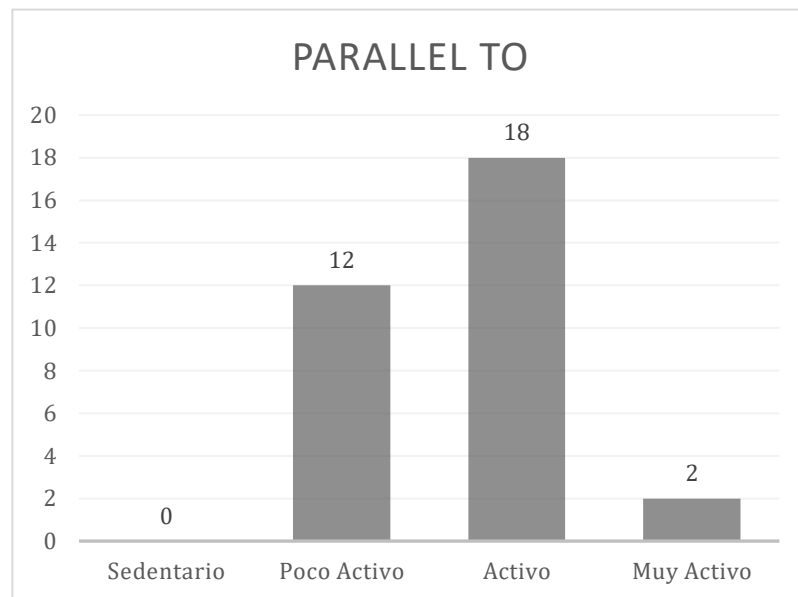


Figure 1 shows that there are no sedentary students in Class A. Most are in the "Active" (18 students) and "Slightly Active" (12 students) categories, while only 2 students are "Very Active." This distribution indicates that, although there is no absolute lack of physical activity, physical activity levels vary mainly between moderate and high.

FIGURE 2

Distribution of Physical Inactivity Levels Among Female Students in Class B

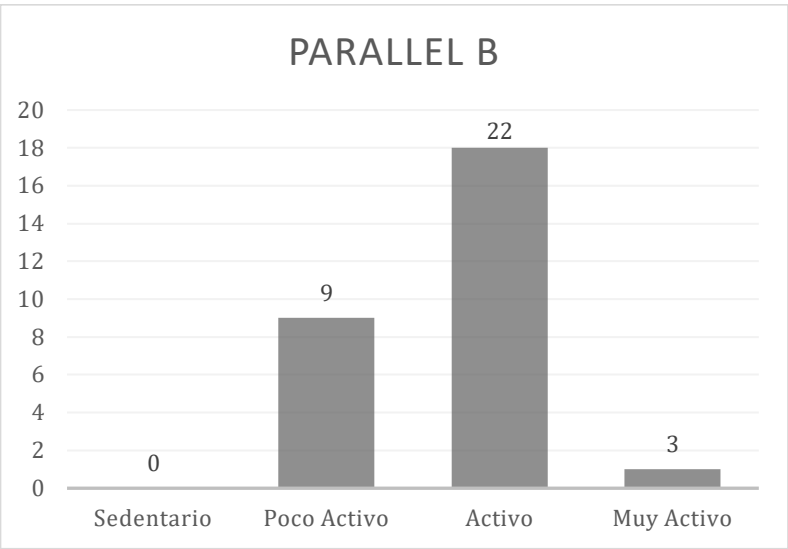
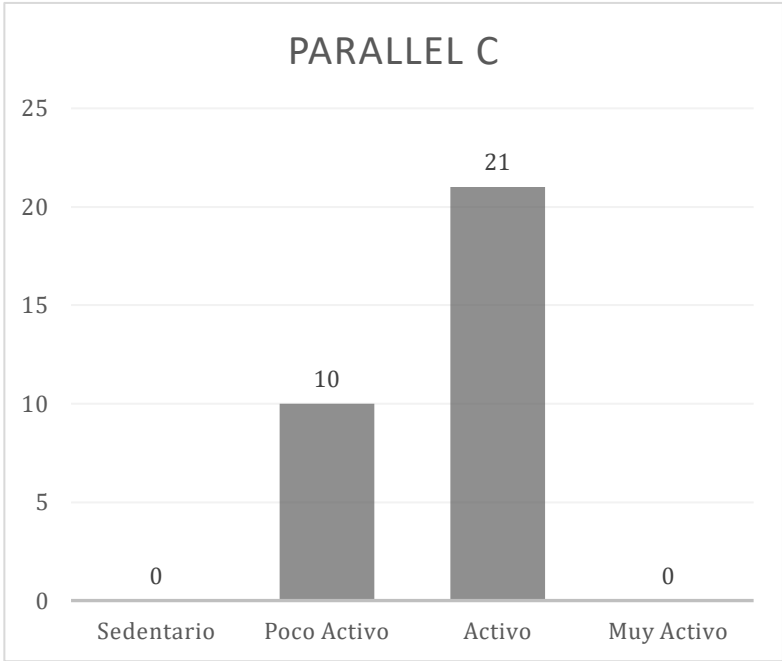


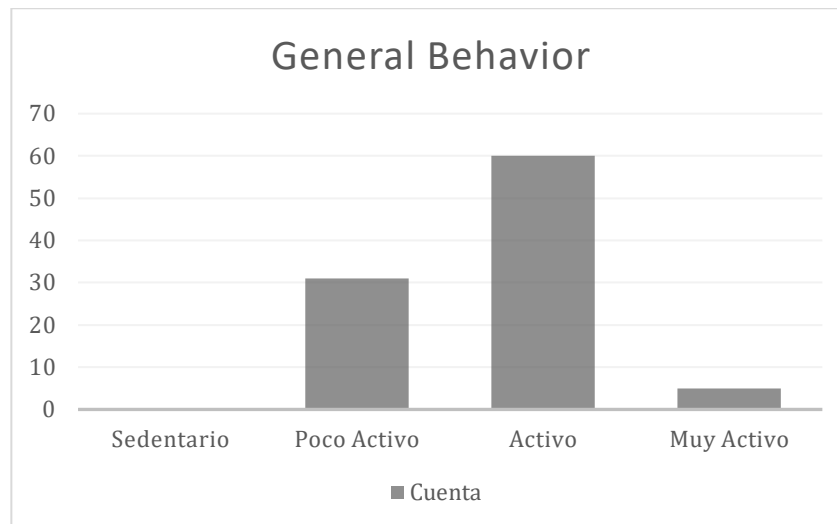
Figure 2 shows that most students are "Active" (22), followed by "Not Very Active" (9). There are 3 very active students and 0 sedentary students. Reflecting moderate levels of physical activity.

FIGURE 3
Distribution of Physical Inactivity Levels Among Students in Class C



Parallel C in Figure 3 shows a similar distribution, with 21 active students, 10 somewhat active students, and no sedentary or very active students. This pattern reflects a consistent trend within the institution toward moderate levels of physical activity.

FIGURE 4
General comparison of sedentary behavior levels across the three parallels.



A comparison of the three groups confirmed that there are no sedentary students and that most students fall into the "Active" and "Somewhat Active" categories. The low representation of "Very Active" students highlights the need to promote higher levels of physical activity within the educational setting.

TABLE 1

Grade Point Average by Level of Physical Inactivity Among Fifth-Grade Students

Level of physical inactivity	Grade Point Average
Not Very Active	9.21
Asset	8.96
Very Active	8.72

Note. No students were recorded in the "Sedentary" category

As shown in Table 1, students classified as "Not Very Active" have the highest grade point average (9.21), followed by those classified as "Active" (8.96) and "Very Active" (8.72). The absence of sedentary students prevents an analysis for that category.

These results confirm that there is no direct linear relationship between increased physical activity and improved academic performance in this sample, supporting the idea that academic performance depends on multiple factors that go beyond a simple classification of physical inactivity.

TABLE 2

ANOVA Results Comparing Academic Performance with Levels of Sedentary Behavior

Source of variation	Sum of Squares	Degrees of freedom	Mean of squares	F	Probability (p)	Critical value F
Among groups	1.8037	2	0.9018	2.6214	0.0781	3.0943
Within groups	31.9948	93	0.3440	-	-	-

Total	33.7985	95	-	-	-	-
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The calculated F-value (2.62) does not exceed the critical value (3.09), and the associated probability ($p = 0.078$) is greater than 0.05; therefore, the null hypothesis is not rejected. This means that there are no statistically significant differences in academic performance based on physical activity level.

TABLE 3
Linear analysis of results

Predictor Variable	Coefficient (β)	Standard Error (SE)	t-value	p-value	Confidence Interval (95%)
Level of Physical Activity (Active vs. (Not Very Active)	0.25	0.12	2.08	0.04	[0.01, 0.49]
Level of Physical Activity (Very Active vs. (Not Very Active)	0.18	0.13	1.38	0.17	[-0.08, 0.44]
Gender (Girls vs. (Children))	-0.15	0.10	1.50	0.14	[-0.35, 0.05]
Age	0.03	0.02	1.50	0.14	[-0.01, 0.07]
Constant	7.50	0.50	3:00 p.m.	<0.001	[6.52, 8.48]

To provide a more comprehensive interpretation of the results, a multiple linear regression analysis was conducted to assess the relationship between physical activity levels and academic performance, controlling for variables such as gender and age. The results showed a significant positive correlation ($p < 0.05$), although the effect size was small ($\eta^2 = 0.02$). This suggests that, although there are no significant differences in academic performance based on physical activity level, there is a trend toward a positive relationship that might be more evident in a longitudinal study.

Discussion and Conclusions

Discussion

The results of this study reveal a complex relationship between a sedentary lifestyle and academic performance among fifth-grade students; although no statistically significant differences in academic performance were found based on physical activity level ($p = 0.078$), students with higher levels of physical activity showed a tendency toward higher grade point averages.

This finding is consistent with previous studies that have found a positive, though not always statistically significant, relationship between physical activity and academic performance (Medina et al., 2024; Fraile García et al., 2019). However, it is important to note that academic performance is a complex construct that depends on a multidimensional interaction of cognitive, affective, pedagogical, and contextual factors (Ariza et al., 2018; Robertson, 2012).

The ANOVA analysis showed no significant differences between the groups ($F = 2.62$, $p = 0.078$), suggesting that, in this study, the level of physical activity does not have a significant impact on academic performance. This result could be attributed to the influence of uncontrolled external variables, such as study habits, family support, the quality of instruction, and the weekly academic workload. These factors have previously been identified as important determinants of academic performance (Alj and Bouayad, 2024).

The findings of this study have important implications for educational practice; most students fall into the “Active” and “Somewhat Active” categories, indicating a general trend toward moderate physical activity. This distribution suggests that, although no completely sedentary students were identified, physical activity levels do not meet the standards recommended by the World Health Organization (WHO), which recommends at least 60 minutes of moderate-to-vigorous physical activity daily for children. This reality underscores the need to implement more consistent institutional measures to promote physical activity in the school setting.

As a key educational setting, schools have a responsibility to promote active, healthy, and sustainable lifestyles; This can be achieved not only through physical education classes but also through active breaks, structured recess periods, playful teaching methods, and interdisciplinary projects that integrate physical activity into learning. Furthermore, it is necessary to strengthen shared responsibility among families, schools, and the community to ensure that students maintain a balance between academic time, recreation, rest, and physical activity.

The study also suggests that the relationship between a sedentary lifestyle and academic performance may be moderated by other variables; for example, the multiple linear regression analysis showed a significant positive correlation ($p < 0.05$), although the effect size was small ($\eta^2 = 0.02$). This suggests that, although there are no significant differences in academic performance based on physical activity level, there is a trend toward a positive relationship that might be more evident in a longitudinal study.

Furthermore, the study found that gender and age do not have a significant impact on academic performance in this sample; however, these results may vary in different contexts, which underscores the importance of considering moderating variables in future studies. The results of this study are consistent with the existing literature in several respects. For example, recent studies have found that physical activity can improve memory, attention, and spatial orientation, contributing to students’ overall development (Aznar-Ballesta and Vernett, 2023). However, other studies have found

mixed results, suggesting that the relationship between a sedentary lifestyle and academic performance may be more complex than initially thought (Medina et al., 2024).

Compared with studies that have found a significant relationship between physical activity and academic performance, the present study did not find any statistically significant differences; this could be attributed to differences in study design, sample size, or the variables controlled for. For example, longitudinal studies have found a stronger association between physical activity and academic performance, suggesting that the impact of physical activity may be more evident over the long term (Ortiz-Sánchez et al., 2024).

For future research, it is suggested that longitudinal designs and larger sample sizes be adopted to observe changes in academic performance in relation to sustained physical activity and other indicators, such as motivation, sleep, diet, and emotional well-being. These studies would make it possible to determine more precisely whether a sedentary lifestyle acts as a progressive risk factor for learning or whether its influence depends on interactions with other conditions.

In addition, it is recommended to include additional measures of academic performance, such as standardized tests, to ensure a more comprehensive assessment; this would allow for a more direct comparison with previous studies and a better understanding of the factors that influence academic performance.

Conclusions

This study has shown that moderate physical inactivity is prevalent among fifth-grade students in the General Basic Education program at La Inmaculada School. This suggests that, although no completely sedentary students were identified, physical activity habits do not meet the levels recommended internationally by the World Health Organization (WHO), which recommends at least 60 minutes of moderate- to vigorous-intensity physical activity per day for children. A significant proportion of students were classified as "not very active," indicating that their physical activity is insufficient to ensure comprehensive physical and cognitive development.

These findings underscore the need to implement more consistent institutional measures—both in school administration and in local education policies—to strengthen the role of physical education and promote it as a cross-cutting component of student education. The results also show that the overall academic performance of the students evaluated remains within an acceptable and consistent range, with no significant differences across the various levels of physical activity.

Although the averages obtained by the "very active" groups are slightly lower than those of the "not very active" or "active" groups, these differences are not statistically significant; this variation could be attributed to the influence of external variables not controlled for in the study, such as study habits, family support, the quality of instruction, and the weekly academic workload. These factors are consistent with the findings of Ariza et al. (2018) and Robertson (2012), who argue that academic performance is the result of a multidimensional interaction of cognitive, affective, pedagogical, and contextual variables, and cannot be attributed exclusively to the level of physical activity.

Statistical analysis ($p = 0.078$) did not confirm a significant relationship between levels of physical inactivity and academic performance, although a slight negative trend was identified, suggesting that students with lower levels of physical activity might perform slightly worse in the long term. This result, while not conclusive, provides

empirical evidence supporting the importance of continuing to explore the relationship between physical activity and academic performance.

Future research should employ longitudinal designs and larger sample sizes to examine how academic performance changes in relation to sustained physical activity and other indicators, such as motivation, sleep, diet, and emotional well-being. These studies would make it possible to determine more precisely whether a sedentary lifestyle acts as a progressive risk factor for learning or whether its influence depends on its interaction with other conditions.

The use of the Pictorial Questionnaire on Children's Physical Activity (C-PAFI) proved to be a valid, reliable, and relevant instrument for measuring physical activity levels in children. Its visual format and accessible language made it easier for fifth-grade students to understand the items, ensuring accurate and context-specific data collection. This tool is presented as a useful resource to be incorporated into periodic institutional evaluations and could serve as a technical input in planning school health promotion strategies and monitoring student physical well-being. Furthermore, its systematic application would allow for the generation of comparative indicators that facilitate data-driven educational decision-making.

More broadly, the findings of this study reinforce the idea that physical inactivity among children is an educational and public health issue that must be addressed from a comprehensive perspective; schools, as key educational settings, have a responsibility to foster active, healthy, and sustainable lifestyles by promoting physical activity not only during physical education classes but also through active breaks, structured recess periods, playful teaching methods, and interdisciplinary projects that integrate physical movement into learning. In addition, it is necessary to strengthen shared responsibility among families, schools, and the community to ensure that students maintain a balance between academic time, recreation, rest, and physical activity.

Although the relationship between a sedentary lifestyle and academic performance is not statistically significant, promoting regular physical activity remains an essential strategy for students' holistic development. Encouraging physical activity in childhood not only contributes to physical well-being but also strengthens cognitive, socio-emotional, and attitudinal aspects that indirectly influence learning; therefore, this research serves as a starting point for designing school policies aimed at preventing a sedentary lifestyle and creating more active, healthy, and equitable educational environments, in line with the Sustainable Development Goals related to quality education and children's health.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding this research.

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