



Structural determinants of health and lifestyles in students from Cali, Colombia

Determinantes estructurales de la salud y estilos de vida en estudiantes de Cali, Colombia

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Abstract

Objective: To determine the influence of structural health determinants on the lifestyle habits of school-aged children and adolescents in Cali, Colombia (2021–2023).

Methods: This was a retrospective observational study with a descriptive design and analytical scope, conducted on a sample of 825 schoolchildren aged 8 to 17 years from five private educational institutions in Cali. Sociodemographic factors, diet quality, and sedentary time were analyzed using several parsimonious binary logistic regression models.

Results: Of the total sample, 53.3% were male and 68.8% were adolescents aged 12 to 17. Poorer diet quality was associated with a lower paternal education level (primary education, OR = 2.58). Spending more than 480 minutes per day on sedentary activities was associated with being female (OR = 0.70), living only with the father (OR = 3.84), and belonging to a middle socioeconomic stratum (OR = 2.43).

Conclusions: Associations were found between sedentary behavior, physical activity, diet quality, and certain structural health determinants. Gender and the father's education level were notable predictors in the models. Longitudinal studies are recommended to establish causality.

Keywords

Determinants; diet quality; physical activity; sedentarism.

Resumen

Objetivo: Determinar la influencia de los determinantes estructurales de la salud en los estilos de vida de niños y adolescentes escolarizados en Cali, Colombia (2021-2023).

Métodos: Estudio observacional retrospectivo de diseño descriptivo con alcance analítico, realizado en una muestra de 825 escolares de entre 8 y 17 años, provenientes de cinco instituciones educativas privadas de la ciudad de Cali. Se analizaron variables sociodemográficas, calidad de la dieta y tiempo sedentario, utilizando modelos logísticos binarios parsimoniosos.

Resultados: El 53,3 % de la muestra correspondía al sexo masculino y el 68,8 % a adolescentes entre los 12 y 17 años. Una peor calidad de dieta se asoció con un menor nivel educativo del padre (educación primaria, OR = 2,58). Dedicarse a más de 480 minutos diarios de actividades sedentarias se asoció con el sexo femenino (OR = 0,70), vivir solo con el padre (OR = 3,84) y pertenecer a un estrato socioeconómico medio (OR = 2,43).

Conclusiones: Se identificaron asociaciones entre el sedentarismo, la actividad física, la calidad de la dieta y ciertos determinantes estructurales de la salud en esta población. El sexo y el nivel educativo del padre fueron relevantes en los modelos obtenidos. Se requieren estudios longitudinales para establecer relaciones causales.

Palabras clave

Actividad física; calidad de la dieta; determinantes; sedentarismo.

Introduction

Social determinants of health (SDH) refer to non-medical conditions that influence an individual's health outcomes (Chunara et al., 2024). These encompass the conditions in which people are born, grow, and live throughout their lives, and are estimated to account for 30% to 50% of health outcomes worldwide (Centeno & Vera, 2019; Obregón, 2020). Within this broad framework, structural social determinants of health (SSDH) represent the upstream forces shaping social stratification, such as socioeconomic status, parental education, gender, educational level, income, and ethnicity which in turn determine opportunities for adopting healthy or unhealthy lifestyles across the life course (Hassan, Chisty & Bui, 2024).

Lifestyle behaviors, namely physical activity, diet quality, and sedentary patterns are modifiable profoundly shaped by these social determinants, particularly during childhood and adolescence, a period in which lifelong habits are established (Castro et al., 2024; Dubuc, Aubertin & Karelis, 2020). Various studies have demonstrated that low levels of education, income, or socioeconomic status are associated with higher screen time (by 21–25% more), poorer dietary quality (OR = 1.6), and reduced physical inactivity in children (Cediel et al., 2020; Dubuc et al., 2020). Significant associations were observed between maternal employment and paternal education with child health ($p < 0.001$ and $p < 0.05$, respectively), as well as poorer nutritional quality among Afro-descendant and Hispanic children compared to their white counterparts (Mensch et al., 2019). In Norway, Heradstveit et al. (2020) reported that adolescent girls with less-educated parents had a higher risk of physical inactivity and reduced sports participation (RR = 1.04 and 1.12).

These findings are consistent with evidence from Latin America, where adolescents from socioeconomically disadvantaged families with lower parental education, reduced income, or food insecurity are more likely to present insufficient physical activity, prolonged sedentary time, and poorer diet quality (Bernabe & Carrillo, 2022; Sánchez et al., 2024). For instance, a comparative study in Brazil, Colombia, and Mexico reported that adolescents from socially disadvantaged settings face significant barriers to achieving recommended levels of physical activity and accessing healthy food, which translates into higher prevalence of overweight and obesity (Mendez et al., 2022).

According to the National Survey of the Nutritional Situation in Colombia (ENSIN), excess weight affects 24.5% of children between 5 and 12 years of age and 17.5% of adolescents aged 13 to 17, with even higher prevalence reported in Cali (23.4%). The survey also revealed that 46.3% of adolescents engage predominantly in sedentary behaviors, while only 15% achieve the minimum recommended levels of physical activity (Osorio et al., 2022). Physical inactivity is also linked to poor physical fitness and an increased risk of non-communicable diseases later in life (Chaput et al., 2020).

Therefore, this study aims to examine the influence of structural determinants of health on sedentary behavior, physical activity, and diet quality among students enrolled in private schools in Cali, Colombia. By addressing this gap, the study seeks to contribute context-specific and culturally relevant evidence for designing interventions that promote healthier lifestyles and reduce inequities among Colombian youth.

Method

The variables related to social determinants were obtained through a self-administered questionnaire specifically designed for this study. These included sex, ethnicity, type of housing, socioeconomic stratum, household composition, parental physical activity, parents' educational level. Additionally, participants' decimal age was calculated based on their date of birth and the date of assessment. Once the age was calculated, the variable was dichotomized into two groups: (8-11 and 12-17 years) to align with primary and secondary school stages, which differ in developmental characteristics, autonomy, and behavioral patterns influencing diet, physical activity, and sedentary habits. The choice of private schools was based on accessibility and the possibility of analyzing students who represent specific structural and socioeconomic characteristics distinct from those typically observed in public education.

Diet quality was assessed using the KRECE-Plus short questionnaire, with results categorized as low-quality diet (≤ 4 points) and medium-to-optimal quality diet (> 4 points) (Correia, 2018; Tapia-Serrano

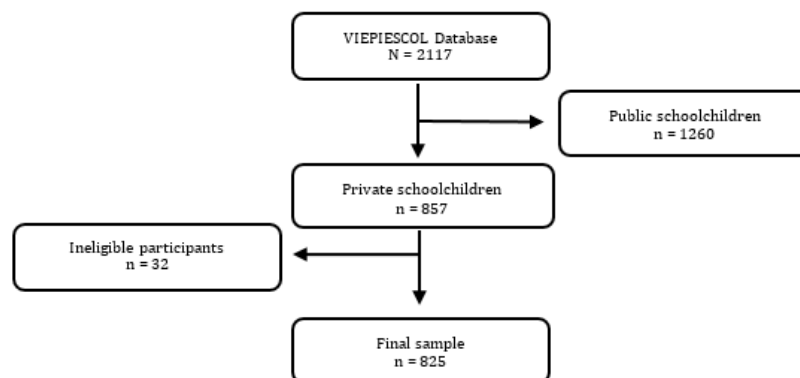
et al., 2021). This instrument has been validated in Colombia child and adolescents' populations, demonstrating strong psychometric properties both globally and across its dimensions, with high internal consistency (Cronbach's $\alpha = 0.79$) (Carrillo & Ramírez-Vélez, 2020).

Sedentary time and physical activity were measured using the Youth Leisure-Time Sedentary Behavior Questionnaire (YLSBQ) was used, which comprises 14 items distributed across five components: screen time; educational sedentary time (EST), social sedentary time (SST); sedentary time from other activities (STOA); and physical activity time. Participants reported time spent on specific activities during weekdays and on weekends. These data were adjusted according to the questionnaire's guidelines, and average daily time (minutes) was calculated for each item. Total sedentary time (TST) was obtained by summing the four sedentary components. Sedentary behavior components were dichotomized into ≤ 120 minutes/day and > 120 minutes/day. The TST cut-off was 480 minutes/day, and for physical activity, the threshold was set at 60 minutes/day (Chaput et al., 2020). The YLSBQ exhibits moderate to good reliability and moderate validity for assessing sedentary behavior in youth (Cabañas-Sánchez et al., 2018).

Participants

A sample of 825 students from the city of Cali, Colombia, was included. The study was conducted as a census of students enrolled in five private schools in Cali, Colombia between September 2021 to January 2023. All students registered in the previously collected the Vigilancia Epidemiológica en Escolares Colombianos (VIEPIESCOL), Data collection was conducted exclusively for students who met the inclusion criteria in the database and had complete information. Participation required written informed consent from parents or legal guardians and the students' own informed assent. Those with incomplete information were excluded.

Figure 1. Sample selection



Note: Ossa et al. (2025)

Sample selection

Data were accessed with authorization from the project's principal investigator. Physical questionnaires were available for verification, allowing validation of database entries. A quality control check was performed on 25% of the questionnaires, confirming an error rate below 1%.

Procedure

Potential confounding variables, especially sex and age group, were considered during analysis. Descriptive statistics were computed for anthropometric measures, age, KRECE-Plus diet quality scores, and YLSBQ sedentary and physical activity times, both overall and stratified by sex and age group.

The study protocol was first reviewed and approved by the Ethics Committee for Research Involving Human Subjects of the Institución Universitaria Escuela Nacional del Deporte (Act No. 4, 1.01.03.07,

November 1, 2018) and was classified as “research without risk” in accordance with Article 11 of Resolution 008430 of 1993 issued by the Colombian Ministry of Health. In addition, this study, as part of the VIEPIESCOL project, received ethical approval from the Ethics and Bioethics Committee of Universidad Libre (record number CEB-34-2023, May 8, 2023).

Data analysis

Normality was assessed using the Shapiro-Wilk test for the entire sample and subgroups. Descriptive statistics are presented with appropriate measures of central tendency and dispersion. Sociodemographic variables are reported as absolute and relative frequencies due to their categorical nature. Group differences by sex and age were evaluated using Student’s t-test or Mann-Whitney U test as appropriate.

To explore associations, parsimonious binary logistic regression models were built for each lifestyle variable: diet quality, physical activity, total sedentary time, and each sedentary behavior component. All models were adjusted for sex and age group (8–11 and 12–17 years). Statistical analyses were conducted using SPSS version 27, with a significance threshold of $\alpha = 0.05$.

Results

Table 1 shows the distribution of sociodemographic factors among the study participants. Of the total sample (N = 825), 53.3% were male, and 68.8% were adolescents aged 12 to 17 years. Mestizo ethnicity was predominant (50.9%).

Table 1. Percentage distribution of sociodemographic factors

Sex		
Male		440 (53.3%)
Female		385 (46.7%)
Age group		
Children (8-11 años)		257 (31.2%)
Adolescents (12-17 años)		568 (68.8%)
Ethnicity		
White		334 (40.5%)
Afro -descendant		53 (6.4%)
Mestizo		420 (50.9%)
Indígenous		18 (2.2%)
Type of Housing		
House		567 (68.7%)
Gated Community		258 (31.3%)
Socioeconomic status		
Stratum 1 – 2		77 (9.3%)
Stratum 3 – 4		598 (72.5%)
Stratum 5 – 6		150 (18.2%)
Co-residence		
Both Parents		551 (66.8%)
Mother		210 (25.5%)
Father		32 (3.9%)
Otro Relative		32 (3.9%)

Note: Ossa et al. (2025).

Regarding housing, 68.7% of the participants reported living in a house (not in a gated community or apartment), with 72.5% belonging to socioeconomic strata 3 and 4. Two-thirds (66.8%) lived with both parents, while 25.5% lived only with their mother.

Parental Characteristics

Table 2 summarizes parental characteristics. Regarding parents, 61% Sixty-one percent reported engaging in physical activity, and nearly half had attained a university-level education (fathers: 45.9%; mothers: 48.6%), whereas approximately 6% had completed only primary education.

Table 2. Percentage distribution of parental characteristics

At least one parent exercises		
Yes		503 (61.0%)
No		322 (39.0%)
Father's educational level		
Primary		46 (5.6%)
Secondary		233 (28.2%)
University		379 (45.9%)
Postgraduate		167 (20.2%)
Mother's educational level		
Primary		42 (5.1%)
Secondary		180 (21.8%)
University		401 (48.6%)
Postgraduate		202 (24.5%)

Note: Adapted from Ossa et al. (2025).

Lifestyle Habits

Sedentary patterns and diet emerged as key concerns. Although 61.3% of students accumulated ≤ 480 minutes/day of sedentary activities, more than half (54.8%) exceeded recommended limits for screen time. Only 37.6% of students met the WHO physical activity guideline of ≥ 60 minutes/day, and a mere 14.7% were classified as having an optimal diet (Table 3).

Table 3. Percentage Distribution of Measured Lifestyle Habits

Total Sedentary Time (minutes/day)		
Up to 480		506 (61.3%)
More than 480		319 (38.7%)
Screen Time (minutes/day)		
Up to 120		373 (45.2%)
More than 120		452 (54.8%)
Educational Sedentary Time (minutes/day)		
Up to 120		473 (57.3%)
More than 120		352 (42.7%)
Social Sedentary Time (minutes/day)		
Up to 120		641 (77.7%)
More than 120		184 (22.3%)
Other Sedentary Time (minutes/day)		
Up to 120		739 (89.6%)
More than 120		86 (10.4%)
Time Spent in Physical Activity (minutes/day)		
Less than 60		515 (62.4%)
60 or more		310 (37.6%)
Diet Quality		
Optimal Diet		121 (14.7%)
Low Quality Diet		704 (85.3%)

Source: Authors' own elaboration

Table 4. Logistic models for lifestyle habits and structural health determinants

Factors	Diet Quality	TST	STS	EST	SST	OST	PAT
Sex (Female)	0.63 (CI 0.42 - 0.94)*	0.70 (CI 0.52 - 0.94)*	1.58 (CI 1.20 - 2.10)*	0.73 (CI 0.55 - 0.96)*			1.43 (CI 1.07 - 1.90)*
Father's education (Postgrad = Ref)	(p 0.002)*	(p 0.055)*	(p 0.11)*	(p 0.059)*	(p 0.010)*	(p 0.065)*	
Primary	2.58 (CI 0.95 - 6.98)	1.54 (CI 0.77 - 3.07)	1.55 (CI 0.79 - 3.03)	0.39 (CI 0.19 - 0.80)*	3.41 (CI 1.61 - 7.24)*	2.98 (CI 1.12 - 7.93)*	
Secondary	2.11 (CI 1.25 - 3.56)*	0.89 (CI 0.58 - 1.38)	1.32 (CI 0.87 - 1.97)	0.70 (CI 0.47 - 1.05)	1.65 (CI 0.98 - 2.80)	1.33 (CI 0.62 - 2.86)	
University	2.37 (CI 1.48 - 3.80)*	1.37 (CI 0.93 - 2.02)	1.58 (CI 1.09 - 2.29)*	0.75 (CI 0.52 - 1.08)	1.86 (CI 1.14 - 3.03)*	2.01 (CI 1.10 - 3.98)*	
Parents do not exercise			1.58 (CI 1.18 - 2.11)*				
Age group (Children 8-17 years)					0.63 (CI 0.43 - 0.92)*		
Co-residence (Other relatives = Ref)		(p 0.07)*					



Both parents	1.61 (CI 0.72 – 3.62)						
Mother only	1.71 (CI 0.74 – 3.96)						
Father only	3.84 (CI 1.32 – 11.14)*						
Socioeconomic status (Stratum 5–6)	(p 0.011)*						
Stratum 1–2	2.43 (CI 1.36 – 4.36)*						
Stratum 3–4	1.43 (CI 0.97 – 2.12)						
Mother's education (Postgrad = Ref)							(p 0.009)*
Primary							0.73 (CI 0.37 – 1.46)
Secondary							0.77 (CI 0.51 – 1.16)
University							0.55 (CI 0.39 – 0.78)*
Constant	4.09 (p 0.000) *	0.28 (p 0.007) *	0.58 (p 0.004) *	1.17 (p 0.388) *	0.20 (p 0.000) *	0.07 (p 0.000) *	0.71 (p 0.036) *

* Significant OR (p < 0.05)

TST: Total Sedentary Time; STS: Screen Time Sedentarism; EST: Educational Sedentary Time; SST: Social Sedentary Time; OST: Other Sedentary Time; PAT: Physical Activity Time.

Multivariable logistic regression models (Table 4) identified several structural determinants associated with lifestyle behaviors. Paternal education was a consistent explanatory factor: lower education levels were associated with poorer diet quality and higher sedentary behavior across several domains. Socio-economic disparities also emerged; students from lower strata (1–2) were more likely to exceed total sedentary time thresholds compared to their peers from higher strata. Family composition mattered as well, with children living only with their father showing greater risk of excessive sedentary time.

Sex differences were evident but nuanced. Girls had lower odds of accumulating excessive total sedentary time, yet they were more likely to exceed screen-time limits and simultaneously more likely to meet physical activity recommendations. These patterns suggest gendered differences in lifestyle behaviors that warrant further exploration.

Interestingly, parental physical activity was inversely associated with children's screen time, but not consistently protective across other domains. Similarly, maternal education was inversely related to children's likelihood of meeting physical activity guidelines, indicating that higher maternal education did not necessarily translate into healthier behaviors in this population.

Table 5. Multivariate associations between sociodemographic factors and children's diet quality, sedentary behaviors, and PA

Factor	OR (95% CI)	p-value	Interpretation
Sex (Female vs. Male) - Diet Quality	0.63 (0.42–0.94)	0.002	Girls had 37% lower odds of better diet quality
Sex (Female vs. Male) - TST	0.70 (0.52–0.94)	0.055	Girls had 30% lower odds of total sedentary time
Sex (Female vs. Male) - STS	1.58 (1.20–2.10)	0.011	Girls had 58% higher odds of screen sedentary time
Sex (Female vs. Male) - EST	0.73 (0.55–0.96)	0.059	Girls had 27% lower odds of educational sedentary time
Sex (Female vs. Male) - PAT	1.43 (1.07–1.90)	0.036	Girls had 43% higher odds of physical activity
Father's education (Primary vs. Postgrad) - EST	0.39 (0.19–0.80)	0.030	Children of fathers with primary education had 61% lower odds of educational sedentary time
Father's education (Primary vs. Postgrad) - SST	3.41 (1.61–7.24)	0.010	Children of fathers with primary education had 241% higher odds of social sedentary time
Father's education (Primary vs. Postgrad) - OST	2.98 (1.12–7.93)	0.065	Children of fathers with primary education had 198% higher odds of other sedentary behaviors
Father's education (Secondary vs. Postgrad) - Diet Quality	2.11 (1.25–3.56)	0.002	Children of fathers with secondary education had 111% higher odds of poorer diet quality
Father's education (University vs. Postgrad) - Diet Quality	2.37 (1.48–3.80)	0.002	Children of fathers with university education had 137% higher odds of poorer diet quality
Father's education (University vs. Postgrad) - STS	1.58 (1.09–2.29)	0.011	Children of fathers with university education had 58% higher odds of screen sedentary time
Father's education (University vs. Postgrad) - SST	1.86 (1.14–3.03)	0.010	Children of fathers with university education had 86% higher odds of social sedentary time
Father's education (University vs. Postgrad) - OST	2.01 (1.10–3.98)	0.065	Children of fathers with university education had 101% higher odds of other sedentary behaviors
Parents do not exercise - STS	1.58 (1.18–2.11)	0.000	Children of inactive parents had 58% higher odds of sedentary screen time

Age group (8–11 years vs. older) - SST	0.63 (0.43–0.92)	0.027	Younger children (8–11 years) had 37% lower odds of social sedentary time
Father only (caregiver) - TST	3.84 (1.32–11.14)	0.019	Children living only with their father had 284% higher odds of total sedentary time
SES (Stratum 1–2 vs. 5–6) - TST	2.43 (1.36–4.36)	0.011	Children in lower SES had 143% higher odds of total sedentary time
Mother's education (Secondary vs. Post-grad) - PAT	0.55 (0.39–0.78)	0.009	Children of mothers with secondary education had 45% lower odds of physical activity

TST: Total Sedentary Time; STS: Screen Time Sedentarism; EST: Educational Sedentary Time; SST: Social Sedentary Time; OST: Other Sedentary Time; PAT: Physical Activity Time.

Table 5 summarizes the adjusted odds ratios for the relationship between sex, parental education, socioeconomic status, and parental lifestyle with children's dietary quality and activity patterns. Significant associations were observed for sex, father's education, parental physical activity, and socioeconomic status across multiple lifestyle behaviors.

Discussion

This study provides robust evidence on how structural determinants of health specifically parental education, socioeconomic status, family structure, and sex shape the lifestyle habits of children and adolescents in Cali. The alarmingly high prevalence of poor-quality diets (85.3%) is not only a descriptive finding but a pressing public health concern that situates this population at elevated risk of obesity, type 2 diabetes, and cardiovascular diseases later in life (Mahumud et al., 2021). This prevalence is consistent with regional and global reports documenting a nutritional transition characterized by excessive consumption of energy-dense, nutrient-poor foods (Popkin et al., 2022; Vos et al., 2022).

A key contribution of our study is the consistent influence of paternal education across multiple lifestyle domains. Lower paternal education was strongly associated with poor dietary quality and excessive sedentary behaviors. This reflects the well-documented role of educational attainment in shaping health literacy, food purchasing capacity, and parental modeling of healthy behaviors (Vos et al., 2022). Beyond individual knowledge, educational level also serves as a proxy for broader socioeconomic capital, affecting access to healthier food environments and safe recreational spaces (Musić et al., 2021). These findings underscore that interventions targeting childhood nutrition and activity cannot focus solely on individual choice but must address upstream determinants related to educational and socioeconomic inequities.

Gender differences also emerged as significant. Girls were less likely to report poor diet quality and excessive sedentary time yet paradoxically were more likely to achieve physical activity recommendations. This contrasts with previous literature suggesting higher male activity levels (Oviedo et al., 2013; Schwarzfischer et al., 2018). Such discrepancies may be explained by context-specific sociocultural norms. For example, in Cali, boys may experience higher exposure to digital entertainment or face fewer restrictions on screen use, while girls may engage in structured physical activities facilitated by school or family environments. These patterns suggest that lifestyle behaviors are shaped not only by biological sex, but also by culturally mediated gender roles, expectations, and opportunities (Mesquita et al., 2023; Rainham et al., 2022). Future studies should explore these psychosocial mechanisms in greater depth.

Family structure was another determinant, with children living solely with the father showing significantly higher sedentary time. While reduced supervision is a plausible explanation, deeper psychosocial and economic mechanisms may also operate. Single-father households may have fewer caregiving resources, less availability for shared meals or active play, and greater reliance on screen-based entertainment. These findings refine our understanding of the growing evidence linking family dynamics to health behaviors in childhood (Rainham et al., 2022).

From a theoretical perspective, these results contribute to social determinants of health frameworks by empirically showing how structural factors intersect with gender, family, and developmental stages to shape behaviors. They support ecological models of health that emphasize the multilayered influences ranging from family education to neighborhood environments on children's lifestyles. This strengthens the argument that interventions must be multisectoral, combining school-based programs, community infrastructure, and family-centered education.

The implications of our findings are both practical and political. Interventions must go beyond individual-level education to reduce inequities in access to healthy foods and safe spaces for activity. Public policies should prioritize investment in school nutrition programs, community recreation facilities, and parental education campaigns, particularly targeting families with lower educational attainment. At the same time, international health agendas, such as those of WHO and UNICEF, emphasize tackling structural barriers to healthy child development. Our results align with these priorities, providing empirical support for policies that integrate health promotion into education and urban planning.

Limitations and future research. Several limitations should be acknowledged. The cross-sectional design precludes causal inference, and the reliance on self-reported behaviors may introduce recall and social desirability biases, particularly for diet and physical activity. The sample was drawn from urban schools, limiting generalizability to rural populations where structural determinants may operate differently. Moreover, despite including multiple socioeconomic indicators, unmeasured confounders such as parental occupation or household food security may also influence behaviors. Addressing these limitations in future longitudinal and mixed-methods research will be crucial.

Conclusions

This study suggests that structural determinants of health particularly parental education, socioeconomic status, and family structure are strongly associated with diet quality, sedentary behavior, and physical activity among school-aged children in Cali, Colombia. By documenting these associations in an urban Latin American setting, the findings contribute empirical support to theoretical frameworks such as the social determinants of health model and the social ecological model, which emphasize the interplay of individual, family, and contextual factors in shaping health behaviors.

Beyond reinforcing established theory, our results highlight the persistent influence of paternal education across multiple lifestyle domains, suggesting that educational attainment operates not only as a socioeconomic indicator but also as a proxy for health literacy, parenting practices, and resource availability. This underscores the need to refine conceptual models of health behaviors in youth by integrating family-level dynamics as key explanatory mechanisms.

In summary, by situating children's health behaviors within the broader context of structural determinants, this study not only advances theoretical understanding of health inequities in Latin America but also offers concrete directions for policy and practice aimed at fostering healthier lifestyles in future generations.

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