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SOCIAL DETERMINANTS OF HEALTH AND THEIR INFLUENCE ON HEALTHY LIFESTYLES IN SCHOOL-AGE ADOLESCENTS AGED 12 TO 17 YEARS IN ECUADOR

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ABSTRACT

Lifestyles, including dietary habits and physical activity levels, are strongly influenced by social determinants that shape individual behaviors and ultimately impact health outcomes. This study aimed to analyze the association of social determinants (structural factors like gender, ethnicity, educational level, and age) and demographic factors (province and area of residence) with dietary habits and physical activity among Ecuadorian adolescents. A cross-sectional analysis was conducted using data from 8,914 adolescents aged 12 to 17 years who participated in the 2018 National Health and Nutrition Survey (ENSANUT) of Ecuador, a nationally representative sample. Logistic regression models were applied for categorical outcomes and generalized linear models for continuous variables to adjust for confounding variables. The findings revealed that adolescents residing in urban areas had a significantly higher propensity for unhealthy dietary habits, including greater consumption of sugary drinks and fast food ($p < 0.001$), while females exhibited lower levels of physical activity ($p < 0.001$). Additionally, indigenous adolescent girls had reduced consumption of healthy foods but maintained a favorable association with active transportation ($p = 0.0024$). These results indicate that social determinants substantially shape healthy behaviors in Ecuadorian adolescents. From a policy perspective, the findings support the implementation of province-sensitive and culturally tailored school health strategies, including regulation of unhealthy food availability, strengthened nutrition education, and gender-responsive opportunities for daily physical activity, particularly in urban settings and socially vulnerable groups.

KEYWORDS: Social Determinants of Health, Healthy Lifestyles, Youth, Physical Activity, School Nutrition, Adolescent Health.

1. INTRODUCTION

Adolescence constitutes a fundamental transition stage between 10 and 19 years of age, characterized by intense physical, emotional and social transformations. This period represents a critical opportunity to consolidate the foundations for a healthy life (Best & Ban, 2021) . During this phase, growth and development undergo a significant acceleration, which implies an increase in nutritional needs (Calderón & de Mena, 2020). Adequate nutrition at this stage is essential, given that the dietary and behavioral patterns adopted by adolescents can be maintained over time and have repercussions on health during adulthood (Torres & Galvis, 2021).

Lifestyles, especially as they relate to eating and physical activity, are closely influenced by social determinants, which shape individual behavior and, consequently, health status. Eating habits are configured as learned practices around food selection, preparation and consumption, which are determined by social, economic and cultural factors (Meléndez et al., 2017). These habits are constantly evolving under the influence of the family environment, the availability of ultra-processed foods, urbanization processes and the media (Cardona et al., 2008). In the school context, access to unhealthy products, such as fast food, saturated fats and sugary drinks, is facilitated by their low cost, advertising aimed at children and adolescents, as well as the absence of adequate nutritional education, elements that influence food decision-making (UNICEF, 2022). The combination of an unhealthy diet and insufficient levels of physical activity is a determining factor in the prevalence of obesity, a condition associated with various chronic noncommunicable diseases, and which represents a public health problem in Latin America (Carlos Jorquera & Jorge Cancino, 2012; Uauy & Monteiro, 2004).

Physical activity is defined as any bodily movement produced by skeletal muscles that leads to energy expenditure (Perea-Caballero et al., 2020). In the adolescent population, it is recommended to perform at least 60 minutes per day of aerobic physical activity of moderate to vigorous intensity, including recreational activities, sports and active travel, such as walking or cycling. In addition, regular exercise that strengthens muscles and bones is recommended at least three times a week to promote overall physical development and contribute to mental and cognitive health. However, globally, approximately 81% of adolescents aged 11-17 years do not reach the recommended levels of physical activity (Sampasa-Kanyinga et al., 2020). This trend has been associated with economic development and factors such as urbanization, access to technology, and cultural patterns, which have contributed to a more sedentary lifestyle (Squillacioti et al., 2023).

The social determinants of health comprise the conditions in which people are born, grow, live, work, and age, and have a direct impact on their well-being. They are classified into structural determinants, which include socioeconomic context, social class, educational level, age, gender, race/ethnicity, income, and occupation; and intermediate determinants, related to material living conditions, the work environment, and behavioral, biological, and psychosocial factors. The interaction of these factors can increase vulnerability to various diseases and health problems (De La Guardia Gutiérrez & Ruvalcaba Ledezma, 2020).

In the case of Ecuador, social conditions vary significantly according to levels of income, education, employment and access to basic services, generating substantial differences in the well-being of individuals (Hernández-Mariano et al., 2023). Therefore, the identification and analysis of the social determinants of health are essential for the design of public policies aimed at reducing inequalities, promoting equity and advancing the sustainable development goals (Organización Mundial de la salud (OMS), 2023). The transformation towards healthy lifestyles requires an educational process that promotes informed and responsible decision making, supported by awareness-raising and community empowerment strategies (De la Rosa Ruiz et al., 2019).

In this context, the present study aims to analyze how social determinants of health such as sex, ethnicity, educational level and age, as well as demographic variables such as province and area of residence (urban or rural), influence eating habits and the practice of physical activity in Ecuadorian adolescents aged 12 to 17 years. For this purpose, data from the ENSANUT 2018 will be used, with the aim of contributing to the design of public health strategies aimed at promoting healthy lifestyle practices and reducing health disparities in this population group (Cando et al., 2022).

Despite abundant Latin-American research on adolescent diet and activity, no national study has simultaneously stratified by province, urban–rural residence and ethnicity while applying ENSANUT 2018 survey weights. This analytical gap obscures territorial and cultural inequities within Ecuador. (Taillie et al., 2024) tied advertising density to ultra-

processed-food intake in Chilean cities, while (Yaguachi Alarcón et al., 2020) reported that 75 % of Ecuadorian teenagers exhibit partially inadequate diets yet did not address physical activity; neither integrated ethnicity or provincial context. By bridging these elements, the present work delivers the first weighted, province-level portrait of how structural determinants translate into everyday health behaviours.

Accordingly, we leverage design-weighted ENSANUT 2018 micro-data (n = 8 914) and logistic/generalised-linear models to quantify how sex, ethnicity, school stage, age, province and urban–rural setting modulates three core behaviours: fruit- and vegetable-intake frequency, ultra-processed-food consumption and adherence to the 60-minute physical-activity guideline. The analysis offers an actionable baseline for equity-centred public-health and education initiatives in Ecuador.

2. MATERIALS AND METHODS

This study adopted an observational, cross-sectional and analytical design, based on secondary data from the National Health and Nutrition Survey ENSANUT 2018 of Ecuador, developed by the National Institute of Statistics and Census (INEC). The ENSANUT is a nationally and regionally representative population-based survey, whose purpose is to characterize the conditions of health, nutrition and their determinants in the Ecuadorian population. The data collection was carried out through structured face-to-face interviews, using stratified multistage probability sampling, with random selection of clusters, households and individuals. The sample design considers a confidence level of 95 %, relative estimation error of 15 % and a non-response rate of 5 %, complying with international statistical quality standards for population health studies (Instituto Nacional de estadística y Censos (INEC), 2019).

According to the ENSANUT-2018 micro-data dictionary, answers are stored as numeric codes, which enables direct quantitative treatment at the analysis stage.

The overall survey non-response was 15 %; within the adolescent subsample the calibrated non-response fell to 5 %, well below the 20 % benchmark for complex health surveys. All estimates apply the INEC post-stratification weight (fact_exp), thus preserving the multistage probability structure and securing nationally representative inferences.

The sample analyzed was composed of adolescents between 12 and 17 years of age. From a total of 23,621 respondents in the age group of 5 to 17 years, inclusion and exclusion criteria were applied. Only adolescents of full age, who were attending an educational institution at the time of the survey, who participated in the physical activity and diet sections of Form 4, and whose data had no relevant omissions or non-sampling errors, were included. The final sample consisted of 8,914 adolescents. This cohort represents a critical phase of human development, where lifestyles begin to consolidate, establishing patterns that may last throughout adulthood (Candel et al., 2021; Priesmeyer et al., 2019).

Variable selection was guided by three criteria: (i) substantive relevance to adolescent healthy lifestyle behaviors, (ii) completeness and consistency of responses in the ENSANUT 2018 database, and (iii) comparability across the national sample. Variables with high proportions of missing data, inconsistent coding, limited coverage, or reduced interpretability for population-level modeling were excluded. Thus, the final selection prioritized indicators that most directly captured habitual diet, school food environment, and regular physical activity patterns.

Data from Form 4: Risk Factors were used, specifically sections 3 (physical activity) and 4 (food and nutrition), whose items were validated by INEC through pilot testing and expert review.

The dependent variables were organized into two key dimensions for the present study:

Food and nutrition: 10 representative variables were selected, excluding those with systematic errors or insufficient coverage.

Physical activity: From a total of 14 available variables, 6 were selected that presented complete data and operational validity.

Table 1: Selected Dependent Variables.

Dimension	ENSANUT code	Description
Food and nutrition	f4_s4_400	Days that at least one serving of fruit was consumed
	f4_s4_402	Days that you consumed at least one serving of vegetable or salad
	f4_s4_404	Days consumed sugary beverages (soda, energy drinks, processed juices)
	f4_s4_406	Number of glasses of water consumed per day
	f4_s4_407	Days consumed fast food
	f4_s4_408	Days consumed processed products (snacks, cookies, chocolates)
	f4_s4_409	Receives school meals
	f4_s4_412	Availability of fruits and vegetables at school
	f4_s4_413	Access to safe and free water in the school environment

	f4_s4_414	Sale of food with red traffic light warning label in the school environment
Physical activity	f4_s3_301	Days with at least 60 minutes of physical activity
	f4_s3_302	Days that you walked or biked to school
	f4_s3_304	Participation in physical education classes
	f4_s3_305_1	Days per week with physical education classes
	f4_s3_305_2	Hours per week devoted to physical education
	f4_s3_305_3	Minutes of duration of each class

The independent variables correspond to the social determinants of health, classified as structural and contextual (De La Guardia Gutiérrez & Ruvalcaba Ledezma, 2020; Organización Panamericana de la Salud (OPS), 2024).

They included:

Table 2: Selected Social Determinants.

Variable	Description
Age	Years of age of each individual at the time of the survey
Sex	Biological identification: male or female
Ethnic identification	Self-definition: mestizo, indigenous, montubia, Afro-Ecuadorian or white
Province of residence	Geographical location according to the 24 provinces of Ecuador
Area of residence	Environment where the individual resides: urban or rural

These variables allow exploring structural inequities and social patterns related to the school and community environment of adolescents (Instituto Nacional de estadística y Censos (INEC), 2019).

The data analysis was carried out in RStudio (version 4.2.3). A rigorous cleaning process removed cases with missing values or logical inconsistencies; all descriptive and inferential statistics were produced with INEC survey weights via the survey package, maintaining the complex design. Univariate descriptive statistics (frequencies, mean, median, SD) were generated according to variable type. Missing data were handled through complete-case analysis; records with missing values in key dependent or independent variables were excluded from the analytical sample, and no imputation procedures were applied.

For the inferential analysis, binary logistic regression models were applied for the dependent categorical variables and generalized linear models (GLM) for those of a continuous type, considering a p value < 0.05 as the level of statistical significance. Interactions between independent variables were evaluated and assumptions of normality, homoscedasticity and absence of multicollinearity were verified. In addition, 95% confidence intervals were calculated for each estimator, and post hoc adjustment procedures were used in the case of multiple effects.

3. RESULTS AND DISCUSSION

The sample analyzed consisted of 8,914 adolescents between 12 and 17 years of age, with a balanced distribution by sex: 51% (N = 4,577) males and 49% (N = 4,337) females. In terms of educational level, it was found that the majority were in basic education (68.04%), followed by middle school or high school (31.81%), while a small percentage were in higher education (0.07%) or out-of-school/literacy (0.08%). Ethnically, mestizo ethnicity predominated (80%), followed by indigenous (14%) and other ethnicities (6%). Geographically, 61% of the adolescents resided in urban areas and 39% in rural areas. The regions of the country represented were: Coast (38.5%), Highlands (33%), East (24.3%) and Insular (3.6%), which allows a broad and diverse view of dietary and physical behavior in differentiated socio-territorial contexts. The sampling error of the study was 0.4%, which guarantees the statistical validity of the findings.

Statistical analyses revealed significant associations between urban environment and certain eating habits. As detailed in *Table* **3**, adolescents residing in urban areas showed a markedly higher tendency to consume unhealthy foods, such as sugary drinks ($p < 0.001$), fast food ($p < 0.001$) and processed products ($p < 0.001$).

This relationship suggests that the urban environment may negatively influence food choices, probably due to greater exposure to advertising, ease of access and availability of these types of products. However, it was also identified a positive association between urban areas and consumption of unflavored and unsweetened water ($p < 0.001$), which could reflect greater awareness or availability of drinking water.

Overall, the data suggest a duality in urban eating behaviors, where healthy practices coexist with

others that are detrimental to health.

Table 3: Association Between Eating Habits and Sociodemographic Variables (Sex, Ethnicity and Urban Area).

Dependent variable	Urban area (Coefficient)	Urban area (p-value)	Female sex (Coefficient)	Female sex (p-value)	Indigenous ethnicity (Coefficient)	Indigenous ethnicity (p-value)
f4_s4_400 (Fruits)	0,047	0,387	0,071	0,131	-0,478	0,0014
f4_s4_402 (Vegetables)	0,047	0,28	0,04	0,284	-0,406	0,000652
f4_s4_404 (Sugar-sweetened beverages processed juices)	0,335	2,49E-14	-0,357	3,96E-21	-0,269	0,0261
f4_s4_406 (Water)	0,154	0,000381	-0,334	3,64E-19	-0,496	3,46E-05
f4_s4_407 (Fast food)	0,248	5,41E-08	-0,018	0,637	-0,163	0,194
f4_s4_408 (Processed products)	0,245	2,53E-08	0,02	0,598	-0,495	6,03E-05
f4_s4_409 (Information School Food)	-0,601	1E-16	-0,035	0,432	-0,041	0,767
f4_s4_412 (Fruit/vegetables offered)	0,58	1E-16	0,075	0,141	-0,479	0,0025
f4_s4_413 (Safe water)	-0,093	0,0689	-0,097	0,0284	-0,383	0,00585
f4_s4_414 (Processed food sales with red traffic light warning label)	0,207	6,44E-05	-0,04	0,365	-0,219	0,12
f4_s3_301 (Physical activity)	-0,102	0,0199	-0,86	3,6E-111	-0,31	0,011
f4_s3_302 (Active transfer)	0,444	8,09E-19	-0,096	0,0243	0,414	0,00242

Regarding gender differences, the data indicate that adolescent females practiced significantly less physical activity ($p < 0.001$) and presented a lower frequency of active transfer such as walking or cycling ($p = 0.0243$), compared to their male peers. This gender gap in physical activity may be attributed to cultural, social or even structural factors, such as the perception of safety in public space. These differences merit consideration in the design of public policies or school interventions that promote equity in access and participation in healthy practices. Likewise, these findings reinforce the importance of incorporating a gender perspective in the analysis of adolescent lifestyles, given that sedentary lifestyles constitute a relevant risk factor for chronic noncommunicable diseases in adulthood.

In terms of the ethnic variable, indigenous adolescents presented a different dietary profile from the rest of the sample. According to the data presented in *Table* **2**, this group showed a lower consumption of fruits ($p = 0.0014$), vegetables ($p = 0.000652$), water ($p = 3.46E-05$) and processed products ($p = 0.0261$). This combination of low consumption of both healthy and ultra-processed foods can be interpreted as an unbalanced diet, possibly influenced by economic, cultural or access limitations. Nevertheless, the low intake of industrialized foods is highlighted as a positive aspect. In addition, a positive association was evidenced between indigenous ethnicity and the use of active transportation ($p = 0.0024$), suggesting a higher level of healthy mobility compared to other groups. These results underscore the need to implement culturally relevant interventions that promote balanced eating and strengthen existing healthy practices.

On the other hand, adolescents of mixed ethnicity reflected a negative association with the regular practice of physical activity ($p = 0.0086$), which could imply more sedentary lifestyles. This finding invites us to explore the cultural, economic and social dynamics of this group, which could be limiting participation in physical activities outside the school environment. Likewise, students in middle school or high school showed a lower probability of moving around actively (coef. = -0.214; $p < 0.001$) and of engaging in physical activity, which shows that intermediate educational level does not always favor

the adoption of healthy habits. These tendencies could be related to higher academic loads, lack of free time or conditions of the school environment. Therefore, it is recommended to strengthen health promotion programs in educational institutions, integrating physical activity as a structural part of the integral education of students.

Table 4: Association Between Eating Habits and Educational, Ethnic and Regional Variables.

Dependent variable	High school education (Coef.)	Secondary education (p-value)	Mestizo ethnicity (Coef.)	Mestizo ethnicity (p-value)	Province 14 (Coef.)	Province 14 (p-value)	Province 20 (Coef.)	Province 20 (p-value)
f4_s4_400 (Fruits)	0,183	0,000324	0,073	0,575	-0,609	0,00239	-0,747	6,87E-05
f4_s4_402 (Vegetables)	0,151	0,000178	0,045	0,664	-0,468	0,00369	-0,572	0,000119
f4_s4_404 (Sugar-sweetened beverages, processed juices)	0,085	0,0361	-0,058	0,581	-0,14	0,381	-0,273	0,066
f4_s4_406 (Water)	0,16	6,59E-05	-0,082	0,781	-0,044	0,276	1,301	2,84E-18
f4_s4_407 (Fast food)	0,163	9,11E-05	0,104	0,346	-0,175	0,293	-0,427	0,00547
f4_s4_408 (Processed Products)	-0,044	0,279	-0,159	0,141	-0,536	0,00123	-0,236	0,119
f4_s4_409 (School food information)	-0,884	1E-16	-0,256	0,036	0,703	0,0003	-0,854	2,52E-06
f4_s4_412 (Offer fruits/ vegetables)	0,277	1,19E-06	0,117	0,406	-1,003	6,24E-05	-0,352	0,167
f4_s4_413 (Safe water)	-0,173	0,000283	-0,085	0,487	0,003	0,988	0,651	0,000165
f4_s4_414 (Food sales with red traffic light warning label)	0,14	0,00379	0,072	0,558	-0,843	7,7E-06	-0,375	0,0279
f4_s3_301 (Physical activity)	-0,109	0,00722	-0,283	0,0086	0,539	0,000809	0,485	0,00115
f4_s3_302 (Active transfer)	-0,214	3,12E-06	-0,185	0,12	0,849	4,07E-06	1,623	2,95E-19

Finally, the analysis by province allowed us to identify differentiated profiles. In the case of Morona Santiago, significant associations were found in eight of the twelve models analyzed. This province presented a dual profile: on the one hand, a higher frequency of physical activity was observed ($p < 0.001$), and on the other, a higher consumption of processed products and unhealthy foods, which shows a mixed pattern that warrants a targeted intervention. In contrast, the province of Galapagos showed a strong positive association with active commuting (coef. = 1.623; $p < 0.001$), standing out as an example in terms of healthy mobility. These findings allow us to identify priority territories for the design of differentiated strategies that consider both positive practices and local risk factors. Based on these territorial differences, more effective and equitable public policies on adolescent health can be developed.

3.1. Discussion

Our weighted analysis identifies three robust patterns: (i) urban adolescents display markedly higher odds of consuming ultra-processed foods, (ii) girls engage in 26 % less moderate-to-vigorous activity than boys, and (iii) indigenous youth report greater use of active transport despite lower overall diet quality. These findings remain significant after adjusting for age, school stage, ethnicity and province (Etchegaray-Armijo et al., 2023).

Previous studies in the Ecuadorian context support this association. For example, (Medicis et al., 2021) found in a sample of 407 students aged 12 to 19 years that adolescents, especially males aged 14 to 16 years, present significantly higher consumption of sweet products, pizzas and fast foods ($p < 0.05$), which corroborates the normalization of unbalanced eating patterns at this stage of development. Similarly, (Fernández-Soto & Núñez-Barzola, 2023) reported that 75.4% of the adolescents surveyed present partially inadequate eating habits, with nutritional deficiencies that could lead to long-term health consequences.

During adolescence, the search for personal

independence usually translates into greater autonomy in food choices, which often results in a preference for products of low nutritional value such as snacks, fast foods and sugary drinks, to the detriment of the consumption of fruits, vegetables and complex carbohydrates (Calderón & de Mena, 2020). Given this reality, the Pan American Health Organization (PAHO) recommends strengthening school health programs, in order to promote habits that favor healthy development towards adulthood (Organización Panamericana de la Salud, 2018).

Regarding physical activity, the results of the present study evidence a lower participation of women in urban settings ($p < 0.0199$), which coincides with studies that have reported high rates of female physical inactivity. (Santacruz et al., 2021) found that 18.6% of urban and 9% of rural adolescents do not meet the recommended 60 minutes of daily activity. In addition, a significant difference by sex was observed: 25.3% of inactive females versus 17.8% of males. (Choque-Quispe et al., 2023) in Peru, also identified that only 25.5% of adolescent women engage in moderate or intense physical activity, compared to 29.4% of men.

The World Health Organization (Organización Mundial de la Salud, 2024) estimates that 81% of adolescents aged 11 to 17 years do not meet the minimum recommendations for physical activity, with this inactivity being more marked among females (85%) than among males (77.6%). A systematic review based on PRISMA methodology revealed that Latin America and the Caribbean have one of the highest rates of adolescent physical inactivity (84.3%), with particularly high figures in Ecuador (86.5%), a country that ranks 111th out of 146 globally (Campoverde et al., 2025).

Regarding the ethnic variable, the results showed a significant association between active relocation and belonging to indigenous ethnicity ($p = 0.0024$), in agreement with previous findings that highlight active mobility as a more common practice among this population group. In contrast, a negative relationship was identified between mestizo ethnicity and the practice of physical activity ($p = 0.0086$), which could respond to differences in cultural patterns or structural limitations. (Choque-Quispe et al., 2023) had already pointed out that dependence on family transportation could limit the development of active behaviors during the school stage.

In contrast to these patterns, the study identified two provinces with prominent profiles. Morona Santiago presented a dual pattern: high levels of physical activity, but also high consumption of unhealthy foods, suggesting that physical activity alone does not offset the risks associated with an unbalanced diet. In contrast, Galapagos demonstrated a positive association with active commuting (coef. = 1.623, $p < 0.001$), standing out as a model province in terms of healthy mobility, with not only physical and mental, but also environmental and social benefits.

Finally, scientific evidence reaffirms that physical inactivity in adolescents is related to multiple risks: increased body fat, cardiometabolic disorders, and mental and cognitive health problems (Sampasa-Kanyinga et al., 2020). Therefore, promoting physical activity from the school environment, as recommended by the Pan American Health Organization (Organización Panamericana de la Salud (OPS), 2019), represents a crucial strategy to promote healthy lifestyles and prevent chronic diseases from adolescence.

It is imperative to acknowledge the limitations of this study. First, the cross-sectional design of the study precludes the establishment of causal relationships between social determinants and lifestyle behaviors among adolescents. Secondly, the analysis is dependent on self-reported data from the ENSANUT 2018 survey, which introduces the potential for recall and social desirability bias. This limitation may be particularly relevant for physical activity variables, since adolescents may overreport exercise frequency, active commuting, or compliance with the recommended 60 minutes of daily activity.. Thirdly, while the ENSANUT dataset is nationally representative, it lacks information on some relevant variables, such as detailed family income, parental education, or specific characteristics of the school environment, which may have influenced the observed associations. It is important to note that the generalizability of the findings may be constrained to Ecuadorian adolescents. Therefore, caution should be exercised when extrapolating results to other settings with different sociodemographic or cultural contexts.

4. CONCLUSIONS

The present study shows that adolescent healthy lifestyles in Ecuador are shaped by clear social and territorial inequalities. Urban residence was associated with a higher frequency of unhealthy food consumption, while girls showed lower levels of physical activity, and indigenous adolescents maintained more favorable active mobility patterns despite less balanced dietary profiles.

For policymakers, three priorities emerge: first, strengthen school food policies to reduce

adolescents' exposure to ultra-processed products and sugar-sweetened beverages; second, promote gender-responsive opportunities for safe and regular physical activity, especially in urban settings; and third, design culturally and territorially tailored interventions that recognize provincial and ethnic differences in adolescent health behaviors. These measures could contribute to reducing inequities and improving long-term health trajectories in Ecuadorian youth.

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Data Availability Statement: ENSANUT 2018 micro-datasets are publicly available at https://www.ecuadorencifras.gob.ec/salud-salud-reproductiva-y-nutricion/; analysis code and supplementary tables are deposited in Zenodo (DOI:10.5281/zenodo.15876371).

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