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Physical activity, screen exposure, sleep, food intake and obesity among Quilombola schoolchildren

Atividade física, uso de telas, sono, ingestão de alimentos e obesidade entre escolares quilombolas

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ABSTRACT

Introduction: Evidence linking obesity to physical activity (PA), screen exposure (SE), sleep, and food intake (FI) among children and adolescents in black Quilombola communities is limited. Objective: To analyze the associations between obesity, sleep deprivation, PA, SE, and FI among Quilombola schoolchildren. Methods: Cross-sectional study including 1,007 rural children (7-9 years) and adolescents (10-15 years) (9.4 ± 1.5 years, 50.5% boys, 17.8 ± 3.5 kg/m²). PA, SE, and FI were assessed by online questionnaire. Parents reported their children's bedtimes and wake-up times on weekdays to definition of sleep deprivation (Children: <9 hours/day; Adolescents: <8 hours/day). Obesity was classified using age- and sex-specific Body Mass Index values. PA and SE were categorized into quartiles (Q1, Q2, Q3). The analysis included descriptive statistics and multiple Poisson regression to estimate the Prevalence Ratio (PR) and 95% Confidence Intervals (95% CI). Co-variables: gender, food insecurity, and maternal education. Results: Obesity prevalence was 8.4% (95% CI: 6.9% - 10.3%), with no difference by age group; in the adjusted analyses, obesity was associated with a higher SE (PR = 2.1; 95% CI =1.13 - 3.87). In the stratified analysis obesity was associated with sleep deprivation (PR = 2.08; 95% CI = 1.07 - 4.05) and SE (Q3: PR = 2.48; 95% CI = 1.17 - 5.26; Q2: PR = 2.18; 95% CI = 1.02 - 4.65) among children. Conclusion: Obesity was associated with SE in the overall sample. Among children, sleep deprivation and high SE more than doubled obesity prevalence. PA was not associated with obesity.

Keywords: Quilombola Communities; Obesity; Children; Adolescent; Cross-sectional studies.

RESUMO

Introdução: Evidências ligando obesidade, atividade física, uso de telas, sono e consumo alimentar em escolares Quilombolas são escassas. Objetivo: Analisar associações entre obesidade, privação de sono, atividade física (AF), exposição a telas (ET) e ingestão alimentar (IA) em escolares Quilombolas. Métodos: Estudo transversal com 1.007 estudantes (7-15 anos) de comunidades rurais (idade = 9,4 ± 1,5 anos, 50,5% meninos, IMC = 17,8 ± 3,5 kg/m²). AF, ET e IA foram mensuradas com questionário online. Pais relataram os horários de dormir e acordar dos filhos, para definir privação de sono (Crianças: <9 horas/dia; Adolescentes: <8 horas/dia). Obesidade foi classificada via índice de massa corporal; AF e ET categorizadas em quartis. Estatísticas descritivas e modelos de regressão de Poisson múltipla estimaram Razão de Prevalência (RP) e Intervalos de Confiança de 95% (IC 95%). Covariáveis: gênero, insegurança alimentar e escolaridade materna. Resultados: Prevalência geral de obesidade foi de 8,4% (IC 95%: 6,9% - 10,3%), sem diferença entre grupos etários; nos modelos ajustados a obesidade associou-se com maior ET (RP = 2,1; IC 95% = 1,13 - 3,87). Nas análises estratificadas a obesidade se associou à privação de sono (RP = 2,08; IC 95% = 1,07 - 4,05) e à ET (Q3: RP = 2,48; IC 95% = 1,17 - 5,26; Q2: RP = 2,18; IC 95% = 1,02 - 4,65) nas crianças. Conclusão: A obesidade foi associada a ET na amostra geral. Nas crianças, privação do sono e alta ET mais do que dobraram a prevalência de obesidade. Atividade física não se associou com obesidade.

Palavras-chave: *Comunidades Quilombolas; Obesidade; Crianças; Adolescentes; Estudos transversais.*

Introduction

Childhood obesity is a systemic disturbance associated with short- and long-term adverse health outcomes, including social, psychological, musculoskeletal, metabolic, gastrointestinal, and respiratory consequences[1]. The prevalence of obesity in school-aged children and adolescents worldwide has increased over the last three decades among both girls and boys. Between 1990 and 2022, childhood obesity more than doubled in most countries[2]. In Brazil, it is estimated at 12.2%, being higher in boys (12.3%) than in girls (10.8%) under 12 years of age, varying from 2.6% to 15.8% among the states[3].

Correlates and determinants of childhood obesity are related to biological aspects of the weight-regu-

lation process and to multiple environmental factors, including preconception, prenatal, and postnatal exposures[4]. Among them, the isolated or combined effects of unhealthy food consumption[5], physical activity (PA), screen exposure (SE), and sleep deprivation[6] have been extensively investigated in urban and rural populations. However, unlike in extensive urban studies, little evidence exists about the impact of these factors on obesity in children and adolescents from Quilombola communities.

Quilombola communities, mostly founded in rural areas, are made up of descendants of enslaved black people. These communities use their quilombo territories to preserve their cultural identity. As a result of the disadvantages stemming from the history of enslavement in Brazil, these communities still experience numerous vulnerabilities, such as limited access to healthcare services and medicines[7], poor quality of living and health[8], and food insecurity[9]. Nowadays, there are 3,158 certified Quilombola communities in Brazil, with 60% located in the Northeast region and 22.6% in the state of Bahia.

Previous studies on obesity in Quilombola communities have reported an alarming prevalence of obesity[10] and abdominal obesity[11]. However, most of these studies were conducted primarily with adults and the elderly. In this sense, evidence on obesity in Quilombola children and adolescents remains scarce. Moreover, there is no evidence on multiple associations between childhood obesity and sleep deprivation, PA, SE, and food intake among Quilombola communities.

Low PA, high screen time, and short duration sleep frequently coexist and interact synergistically, building a risk pattern that increases the likelihood of obesity among children[6]. An unhealthy diet, characterized by a decreased intake of fruits and vegetables and an increased intake of sweetened beverages, fast food, and ultraprocessed foods, is a common outcome associated with excessive SE[12,13]. In turn, there is a relevant increase in the share of ultraprocessed foods in daily food intake, and this process is associated with obesity among children and adolescents[14]. Considering these issues, the current study aimed to analyze the associations between obesity, sleep deprivation, PA, SE, and food intake amongst Brazilian Quilombola schoolchildren.

Methods

This cross-sectional study included a probabilistic sample of children (7-9 years) and adolescents (10-15 years) from rural Quilombola communities in Feira de Santana-Bahia, Brazil (n = 1.007, age = 9.4 ± 1.5 years, 50.5% boys, body mass index (BMI) = 17.8 ± 3.5kg/m^2). The city comprises eight rural districts (Ipuaçu, Bonfim de Feira, São José, Humildes, Tiquaruçu, Jaíba, Jaguara, and Matinha). Currently, four Quilombola communities are certified by the Cultural Palmares Foundation: Lagoa Grande (São José District), Matinha dos Pretos, Fazenda Candeal II, and Moita da Onça (Matinha District). Nevertheless, the whole rural area is mostly composed of communities with descendants of black people from Quilombos; therefore, the study also included data gathered from Humildes and São José Districts. To ensure the generalizability of results, it is important to note that the demographic and socioeconomic indicators of these districts (education levels, income, and access to health services), largely mirror those of Quilombola communities across Brazil. This comparability strengthens the claims of this study's wider applicability in similar settings nationwide.

In 2022, there were 19 Quilombola schools with classes from the 2nd to the 5th grade in Feira de Santana, 16 of them in rural areas with 2,138 enrolled. The sample size calculation considered the following parameters: population of 2,138 students; an expected outcome prevalence of 19.87% of overweight (overweight + obesity) among students; a margin of error set at 3 % points; and a design effect of 1.5. To balance for potential sample losses and refusals, 20% was added to the final calculation, resulting in a targeted sample comprising 929 students.

After random draw 12 schools, the clustered sampling was performed in four stages: (I) stratification of all Quilombola schools within respective districts; (II) calculation of each school's weight within the cluster as percentage after identification of the total student count within each district (cluster) by summing the enrollments in the selected schools; (III) determination of the target sample size in each school by multiplying the calculated sample size by the corresponding school's weight in the cluster; and (IV) selection of participating classes (2nd to 5th grade) within each school, totaling 83 classes, and random drawing of the needed number of students. Figure 1 shows the analytical sample according to the inclusion and exclusion criteria.

All students enrolled in 2nd- to 5th-grade classes were invited. Inclusion criteria: regular school attendance, written parental authorization, and voluntary consent obtained by reading and signing the consent

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form. The study was conducted in accordance with the ethical guidelines outlined in Brazilian National Health Council Resolution No. 466/2012 and received approval from the Research Ethics Committee of the State University of Feira de Santana (CAAE: 29137320.6.0000.0053; Opinion no. 3.994.186). Students with intellectual disabilities and those outside the age range of seven to 15 years were included, but their data were excluded from the statistical analyses.

Measurements of physical activity, screen exposure, and food consumption

These variables were measured via an online previous-day recall self-report questionnaire: Web-CAAFE (available at: https://caafe.ufsc.br/portal/9/detalhes) validated in two Brazilian cities[15,16]. Participants were asked to report PA and screen-based device usage performed in three shifts of the previous day (morning, afternoon, and evening), including:

- **Physical activities:** playing with a ball, play catch-up, soccer, dance, marbles, jump rope, gymnastics, elastics, playing in the park, playing in the water/swimming, ride a bicycle, rollerblading/skateboarding/riding a scooter, flying a kite, dodgeball, hide-and-seek, playing with dog, and hopscotch and SE frequencies were calculated by the sum of all reports, board games, playing with dolls/action figures, playing with toy cars, spinning top/bayblade, listening to music, playing musical instrument, ballet, fighting sports, washing dishes, sweeping.
- **Screen exposure:** TV, mobile, computer/tablet, and video game.

Food consumption was reported in six meals (breakfast, morning snack, lunch, afternoon snack, dinner, and evening snack). In the current study, food consumption comprised the intake of unhealthy food, protein (meat, eggs, fish, and seafoods), beans, and fruit/vegetables (fruits, vegetables, greens, and vegetable soup). Unhealthy food was defined according to Barros and colleagues[13], comprising: noodles, French fries, sausages/processed foods, sandwich cookies, chocolate milk, juice (natural and artificial), soft drinks, sweets, packaged snacks, and fast food. Participants completed the Web-CAAFE at school, in a room with laptops and headphones, after having been instructed about how the software works and how to complete the questionnaire.

Measurement of sleep time and definition of sleep deprivation

Parents reported the children's bedtime and waking up time, and sleep time was calculated by the difference between bedtime and waking up time in hours. Sleep deprivation was defined according to the Brazilian Society of Pediatrics. Participants aged 7-12 years with sleep time <9 h, and those aged 13-15 years with sleep time <8 h/day, were classified as having sleep deprivation.

Anthropometric measurements and obesity assessment

Body weight and height were measured following recommended standardization[17]. Then, the values were used for the calculation of the BMI and classification of weight status, according to the International Obesity Task Force reference curves[18]. Weight and height were measured using a digital scale (AVANUTRI, AVA10, Três Rio, Rio de Janeiro, Brasil) and a portable, detachable stadiometer with a square platform (Seca 217, Cotia, São Paulo, Brazil). Participants were barefoot, without any head adornments, and wearing a school uniform during the measurements.

Potential confounders

Both outcomes and exposures can vary with age, gender, and socioeconomic factors[19]. In this sense, it has been included in modeling as an adjustment variable. In our study, socioeconomic factors include food insecurity and mothers' education. Mother's education was declared according to Brazilian levels of schooling (Primary, High school, and College). Subjects who did not attend school were classified into the Unschooled category.

Food insecurity was measured using two items from the Brazilian Household Scale for Measuring Food Insecurity: "In the last 12 months, how often have you felt hungry but didn't eat because you couldn't afford enough food?" and "In the last 12 months, how often did you eat less than you thought you should because you didn't have enough money to buy food?" Food insecurity was defined as a positive response to both questions.

Processing and data analysis

The daily frequency of unhealthy food intake was obtained by the sum of all the items reported in the six meals. The processing of self-reports of both PA and SE included: 1) multiplication of the number of episodes of each reported item, at the individual level, by the corresponding Metabolic Equivalent of Task (MET)

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value; 2) subsequently, the MET values of the reported items were summed at the individual level to represent daily PA and daily SE. The conversion to MET values has been performed according to the Compendium of Energy Expenditures for Youth[20]; and 3) classifying in quartiles (*Q1, Q2, Q3*). Implausible values for unhealthy food consumption, PA, and SE (>+3SD) were excluded from analysis. The statistical analysis included Poisson regression modeling with a robust variance estimator to estimate Prevalence Ratios (PR) and respective 95% Confidence Intervals (95% CI).

Results

The eligible participants included 1,483 children and adolescents from 12 schools drawn for the study. After considering the exclusion criteria, data from 1,007 participants were analyzed. Refusals and absences during the data collection period corresponded to 0.6% and 4.3%, respectively (Figure 1). Sample characteristics are presented in Table 1.

The overall prevalence of obesity was 8.4%, with no difference among children and adolescents. About 1 in 5 adolescents experienced sleep deprivation on weekdays and had a higher daily frequency of SE compared to children. About half were in the higher tertile of PA daily frequency, with no difference between children and adolescents. Besides the remarkable frequency of beans and protein consumption, the intake of unhealthy food was high in the sample, with no evident difference between children and adolescents.

In the overall sample, the crude and adjusted analyses have shown obesity associated with a higher frequency of SE and unhealthy food intake (Table 2 and Table 3). The high daily frequency of screen usage and the consumption of unhealthy food increase the likelihood of obesity twice among Quilombola schoolchildren from rural areas, regardless of gender and socioeconomic factors (Table 3). There were no associations between PA and obesity in the overall sample, stratified analysis, and in both crude and adjusted models.

Stratified analysis has shown that obesity a associated with sleep deprivation and SE, particularly among children, as observed in both crude (Table 2) and adjusted analyses (Table 3). Among children with sleep deprivation and high frequency of SE, the likelihood of obesity was more than double compared with no sleep deprivation and low exposure to screens (Table 2). No significant associations were observed among adolescents in both crude and adjusted modeling.

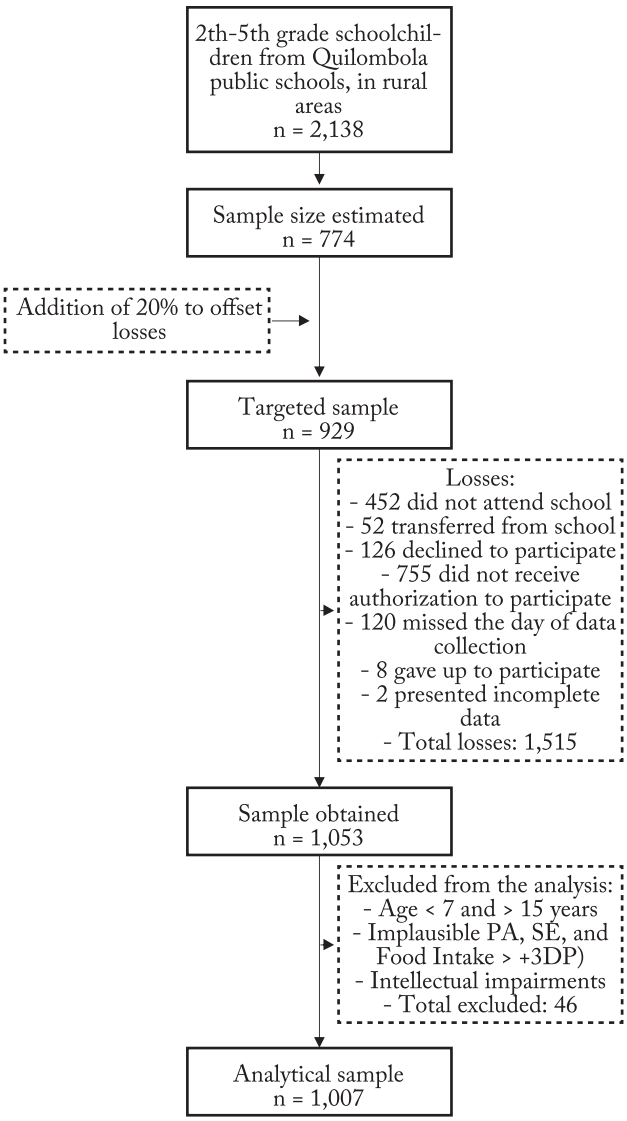

Figure 1 – Study flowchart.

Discussion

Our findings showed that obesity was associated with a higher frequency of SE and consumption of unhealthy food in the overall sample. Sleep deprivation and high frequency of SE more than doubled the likelihood of obesity among children, regardless of gender or socioeconomic factors. No significant associations were observed in adolescents.

Obesity is a concern worldwide and a public health issue, due to high prevalence, risk of tracking from childhood into adulthood, and its link with cardiovascular diseases. Obesity is also highly prevalent among Brazilian Quilombola communities, affecting children, adolescents, and adults, with particularly high rates of abdominal obesity and a higher burden among women and clear links to metabolic syndrome and hyperten-

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Table 1 – Sample characteristics.

Variables	Overall sample (n = 1,007)		Children (7-9 years) (n = 542)		Adolescents (10-15 years) (n = 465)	
	%	95% CI	%	95% CI	%	95% CI
Gender						
Girls	49.6	46.5 - 52.6	49.3	45.1 - 53.5	48.2	43.6 - 52.7
Boys	50.4	47.5 - 52.6	50.7	46.5 - 54.9	51.8	47.3 - 56.3
Obesity	8.4	6.9 - 10.3	9.5	7.2 - 12.2	7.3	5.3 - 10.1
Sleep deprivation	18.3	16.0 - 21.0	15.9	12.9 - 19.4	21.3	17.6 - 25.6
Screen exposure						
Q3 (>3.2)	38.6	35.7 - 41.7	30.3	26.5 - 34.3	48.4	43.9 - 52.9
Q2 (>1.6 to ≤3.2)	27.3	24.6 - 30.2	28.2	24.6 - 32.2	26.2	22.4 - 30.4
Q1 (≤1.6)	34.1	31.2 - 37.1	41.5	37.4 - 45.7	25.4	21.6 - 29.5
Daily physical activity						
Q3 (>10.6)	50.4	47.4 - 53.5	51.1	46.9 - 55.3	49.7	45.1 - 54.2
Q2 (>5.2 to ≤ 10.6)	24.5	22.0 - 27.3	22.9	19.5 - 26.6	26.4	22.6 - 30.7
Q1 (≤ 5.2)	25.0	22.4 - 27.8	26.0	22.5 - 29.9	23.9	20.2 - 28.0
Food intake						
Fruit and vegetables	52.2	49.1 - 55.3	50.4	46.2 - 54.6	54.4	49.8 - 58.9
Beans	68.0	65.1 - 70.8	67.9	63.8 - 71.7	68.2	63.8 - 72.2
Protein	76.6	73.8 - 79.1	76.4	72.6 - 79.8	76.8	72.7 - 80.4
Unhealthy food	80.6	78.1 - 83.0	79.7	76.1 - 82.9	81.7	77.9 - 84.9
Mother's schooling						
Unschooled	4.7	3.5 - 6.4	3.4	2.11 - 5.5	6.3	4.3 - 9.1
Primary	34.1	31.0 - 37.4	30.6	26.6 - 35.0	37.9	33.3 - 42.8
High school	55.7	52.4 - 59.0	60.0	55.4 - 64.3	51.0	46.1 - 55.9
College	5.4	4.1 - 7.1	6.0	4.2 - 8.6	4.8	3.1 - 7.4
Food insecurity	16.3	14.1 - 18.8	16.8	13.8 - 20.3	15.5	12.4 - 19.3

Table 2 – Crude associations between obesity, sleep deprivation, physical activity, screen exposure, and food intake among Brazilian Quilombola schoolchildren.

Variables	Overall sample (n = 1,007)			Children (7-9 years) (n = 542)			Adolescents (10-15 years) (n = 465)		
	PR	95% CI	p value	PR	95% CI	p value	PR	95% CI	p value
Sleep deprivation	1.48	0.91 - 2.39	0.115	1.99	1.06 - 3.71	0.031	1.13	0.53 - 2.43	0.745
Screen exposure									
Q3 (>3.2)	2.33	1.31 - 4.14	0.004	3.01	1.48 - 6.12	0.002	2.00	0.72 - 5.56	0.182
Q2 (>1.6 to ≤3.2)	1.64	0.86 - 3.12	0.132	2.29	1.09 - 4.83	0.029	0.81	0.22 - 3.00	0.756
Q1 (≤1.6)	1.00			1.00			1.00		
Daily physical activity									
Q3 (>10.6)	0.92	0.56 - 1.51	0.751	0.69	0.38 - 1.25	0.225	1.71	0.66 - 4.43	0.273
Q2 (>5.2 to ≤ 10.6)	0.78	0.42 - 1.44	0.427	0.63	0.30 - 1.34	0.232	1.23	0.40 - 3.80	0.715
Q1 (≤ 5.2)	1.00			1.00			1.00		
Food intake									
Fruit and vegetables	1.02	0.66 - 1.57	0.926	0.97	0.57 - 1.66	0.922	0.99	0.47 - 2.08	0.971
Beans	1.00	0.64 - 1.58	0.994	1.32	0.71 - 2.46	0.377	0.64	0.32 - 1.28	0.204
Protein	1.08	0.64 - 1.82	0.766	1.63	0.76 - 3.51	0.208	0.72	0.32 - 1.59	0.414
Unhealthy food	2.27	1.08 - 4.84	0.033	1.80	0.77 - 4.19	0.172	5.43	0.73 - 40.5	0.100

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Table 3 – Adjusted associations between obesity, sleep deprivation, physical activity, screen exposure, and food intake among Brazilian Quilombola schoolchildren.

Variables	Adjustment variables: gender, food insecurity, and mothers' education.			Children (7-9 years) (n = 542)			Adolescents (10-15 years) (n = 465)		
	PR	95% CI	p value	PR	95% CI	p value	PR	95% CI	p value
Sleep deprivation	1.60	0.97 - 2.65	0.066	2.08	1.07 - 4.05	0.030	1.12	0.51 - 2.47	0.769
Screen exposure									
Q3 (>3.2)	2.10	1.13 - 3.87	0.019	2.48	1.17 - 5.26	0.018	1.98	0.58 - 6.72	0.274
Q2 (>1.6 to ≤3.2)	1.64	0.84 - 3.21	0.144	2.18	1.02 - 4.65	0.044	0.93	0.22 - 3.85	0.919
Q1 (≤1.6)	1.00			1.00			1.00		
Daily physical activity									
Q3 (>10.6)	0.99	0.58 - 1.70	0.971	0.68	0.35 - 1.31	0.246	2.05	0.74 - 5.63	0.165
Q2 (>5.2 to ≤ 10.6)	0.87	0.46 - 1.64	0.666	0.77	0.37 - 1.61	0.486	1.30	0.39 - 4.28	0.667
Q1 (≤ 5.2)	1.00			1.00			1.00		
Food intake									
Fruit and vegetables	1.06	0.67 - 1.67	0.809	0.99	0.56 - 1.74	0.967	1.05	0.48 - 2.29	0.903
Beans	0.90	0.56 - 1.46	0.674	1.28	0.66 - 2.49	0.469	0.54	0.26 - 1.12	0.099
Protein	1.13	0.65 - 1.95	0.669	1.77	0.75 - 4.16	0.193	0.68	0.31 - 1.50	0.336
Unhealthy food	2.24	0.99 - 5.05	0.053	1.76	0.72 - 4.29	0.211	5.10	0.69 - 37.5	0.109

Adjustment variables: gender, food insecurity, and mothers' education.

sion[21]. This context increases the vulnerabilities that Quilombola communities already face.

In the current study, the prevalence of obesity among Quilombola schoolchildren fell within the range previously observed in the same region by Cairo et al. (4.3%)[22] and De Jesus et al. (10,7%)[23]. Another previous study carried out with young Quilombola from Goiás, a state in Brazil´s central-west region, reported a prevalence of 17.2% of overweight (including obesity)[24]. Nevertheless, methodological differences between these studies require caution when comparing them. Firstly, the data from Cairo et al.[22] study cover children and adolescents from 10 to 19 years. The best comparison can be made with the findings from De Jesus et al.[23] study, which included children aged 6 to 12 years[23], even though there are potential cultural and economic differences between Quilombola settlements in Feira de Santana and Cachoeira, where De Jesus et al.[23] carried out their study.

Moreover, De Jesus et al.[23] evaluated obesity using the World Health Organization growth charts reference, but we used the International Obesity Task Force (IOTF) references. Using World Health Organization instead of IOTF generally increases estimated childhood obesity prevalence, because World Health Organization uses lower BMI thresholds and leaner reference populations.

The association between sleep duration and childhood obesity has been extensively investigated in recent years. In general, shorter habitual sleep in childhood and adolescence is strongly and consistently associated with a higher risk of overweight/obesity. According to evidence from prospective studies, the risk of overweight/obesity can vary from 30%[25] to double[26]. Strategies to increase sleep duration can reduce the risk of overweight or obesity by 21% per 1 hour/day increment and reduce the annual BMI gain by 0.05 kg/m^2,[27].

Systematic reviews and meta-analyses show that among children with ≥2 hours/day of screen time, the odds of overweight/obesity are up to twice as high as those below this level[28]. In the current study, the prevalence of obesity found among schoolchildren exposed to screens at high daily frequencies was twice that observed among those unexposed.

The link between screen time and obesity risk involves effects on food consumption, sleep duration, PA, and sedentary behavior, specifically sitting time[25]. First, there is consistent evidence that children consume more snacks, energy-dense foods, and sweetened beverages, especially when eating while watching TV, a key moment when they are exposed to food advertising. Recently, similar outcomes have been observed in studies analyzing the effects of other types of screens, such as mobiles, video games, and computers, on the con-

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sumption of unhealthy food among schoolchildren[13].

Secondly, prolonged, interactive SE, particularly near bedtime, is associated with worse and shorter sleep, increased night awakenings, longer sleep latency, and daytime sleepiness in children and adolescents[29]. In turn, short sleep duration is also linked to unhealthy eating patterns and increased caloric intake[30]. These effects were linked to weight gain. Finally, excessive screen use increases sitting time and displaces more active pursuits.

In the current study, no significant associations were observed between obesity and the consumption of fruit and vegetables, beans, or protein. On the other hand, the consumption of unhealthy food increased the likelihood of obesity up to twice in the current study, with no difference among students. It's essential to note that the unhealthy foods in the current study include ultra-processed foods, sugar-sweetened beverages, and fast food.

Evidence from cross-sectional studies indicates that a higher intake of sugar-sweetened beverages can increase the odds of overweight/obesity by 20% in children and adolescents, and fast food by 17%[31]. Furthermore, longitudinal studies confirm that frequent consumption of sugar-sweetened beverages is a significant risk factor for increased adiposity[32]. In turn, ultra-processed foods are strongly linked to higher BMI, waist circumference, and body fat in children, with several cohort and cross-sectional studies showing that increased intake of ultra-processed foods predicts greater adiposity over time[33].

Obesogenic dietary patterns, characterized by high intake of refined grains, processed meats, sugary drinks, and snacks, are associated with higher obesity risk, while healthier patterns (rich in fruits, vegetables, and whole grains) are protective[34]. However, despite the high consumption of beans and protein among young people enrolled in the present study, characterizing the traditional Brazilian dietary pattern, no protective effect was observed. This finding suggests that the high consumption of ultra-processed foods and sugar-sweetened beverages may override the potential benefits of traditional diets, especially when these foods contribute substantially to total energy intake[35].

The provision of these foods in school meals is guaranteed by the Brazilian School Feeding Program (*Programa Nacional de Alimentação Escolar* - PNAE). PNAE aims to provide financial support to state and municipal education departments to contribute to the biopsychosocial growth and development of children, their learning and academic achievements, and the formation of healthy eating habits[36]. Moreover, PNAE establishes that the school meals menu must respect the cultural needs of Quilombola communities. PNAE is a remarkable public policy that guarantees more than access to food, but it also values traditional feeding practices and contributes to food and nutritional security.

A study[37] using data from the National School Health Survey revealed that consumption of school meals, on a regular basis, is associated with higher consumption of beans, raw or cooked vegetables, and fruits among schoolchildren. Consequently, a lower consumption of fried snacks, processed meats, crackers, cookies, and sweets was observed among students who regularly consumed school meals compared to those who did not[37].

Notably, the impact of unhealthy dietary patterns is influenced by factors such as socioeconomic status, parental behaviors, and the broader food environment. The food environment, including neighborhood access to unhealthy foods, also plays a role in shaping dietary behaviors and obesity outcomes[38]. However, in the current study, the socioeconomic factors included – food insecurity and mothers' education – apparently do not affect the association between food intake and obesity.

The current study has strengths to highlight. Firstly, to our knowledge, this is the first study to examine the multiple associations between obesity, sleep deprivation, PA, SE, and food intake among Brazilian Quilombola schoolchildren. Besides the cross-sectional design, we had included a robust and representative sample of schoolchildren from rural areas. The findings add to knowledge on the health of Quilombola communities, people who face social and economic inequalities and vulnerabilities.

Nevertheless, some limitations warrant discussion. First and foremost, the cross-sectional design does not allow for the establishment of cause-and-effect relationships. Consequently, the observed prevalence of obesity within the sample could precede the analyzed behaviors. These behaviors may be outcomes of obesity, responses to the conditions experienced by the participants, or even concurrent events with no causal relationship. Despite this limitation, ample evidence suggests that sleep disturbances, increased screen time, reduced PA, and the consumption of unhealthy foods elevate the risk of obesity among the pediatric population.

Additionally, it's crucial to note that the present study focuses on the daily frequency of SE as reported

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through a 24-hour recall, rather than measuring the duration of screen time. Nevertheless, children exhibiting the highest levels of daily SE displayed approximately double the prevalence of obesity. This leads us to conclude that children with high daily screen frequency may have significant overall SE as well.

We must highlight that our interpretation on this topic relies on attributes of the Web-CAAFE, an instrument able to perform a qualitative analysis of children's behaviors, especially for use in school-based surveys and longitudinal monitoring. Nevertheless, the precision of Web-CAAFE in the prediction of SE is unknown. In other words, do children with a higher daily frequency of SE also have a longer daily duration of SE? This needs to be investigated and incorporated into the ongoing process of refining the tool.

Sleep duration in our study was based on parents' reports. This may be subject to bias, especially among adolescents and youth whose parents have low control over their bedtime and sleep onset. This may lead to overestimation or underestimation of sleep duration. Despite this, the association between sleep deprivation and obesity found aligns with evidence from systematic reviews and meta-analyses.

Generally, parental reports on sleep habits of preschool children have a high correlation with objective measures. However, parents tend to overestimate sleep duration, as they often report bedtime and wake-up time while overlooking sleep latency and nighttime awakenings[39]. This trend is particularly important among adolescents, who are more autonomous regarding their bedtimes and wake-up times.

Finally, we didn't find any significant association between obesity and PA. Childhood obesity is a recognized multifaceted condition resulting from complex interactions between social, genetic, and environmental factors. In this scenario, the relationship between PA and obesity can be bidirectional, i.e, low PA can result in increased body fatness, while the increased fatness can result in PA restriction[40].

Although the Web-CAAFE identifies PA types, its subjective measure may have influenced the findings, as objective measures (e.g., accelerometers) are more commonly used for assessing children's PA. Additionally, unmeasured factors, such as biological maturation and environmental characteristics of Quilombola communities, may also influence obesity.

In conclusion, SE was associated with obesity among Quilombola schoolchildren. Sleep deprivation and frequent SE more than doubled obesity prevalence among children, while PA showed no association. School- and community-based interventions to prevent and control childhood obesity in Quilombola communities may include actions to avoid excessive screen time, to reduce or avoid unhealthy food intake, to reinforce school meals, and to promote the consumption of in natura or minimally processed foods produced within communities themselves. These strategies may improve sleep habits and promote a healthier lifestyle.

Conflict of interest

The authors declare no conflict of interest.

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Author's contributions

Jesus GM: Conceptualization; Methodology; Software; Formal analysis; Investigation; Data curation; Supervision; Project administration; Visualization; Writing – original draft; Writing – review & editing; Approval of the final version. Araujo LDMS, Barros AKC, Pires MR and Santana JPC: Investigation; Funding acquisition; Writing – review & editing; Approval of the final version. Novais LO: Investigation; Writing – review & editing; Approval of the final version.

Declaration regarding the use of artificial intelligence tools in the article writing process

The authors did not use artificial intelligence tools for preparation of the manuscript.

Availability of research data and other materials

Data is avaliable upon request.

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Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

Reviewer A

Anonymous

Format

- Does the manuscript comply with the manuscript preparation guidelines for submission to the Brazilian Journal of Physical Activity and Health?
  Yes.
- Regarding formal aspects, is the manuscript well structured, containing the following sections: Introduction, Methods, Results, and Discussion (with the conclusion as part of the Discussion)?
  Yes.
- Is the language appropriate, and is the text clear, precise, and objective?
  Yes.
- Was any evidence of plagiarism identified in the manuscript?
  No.
  Suggestions/comments:
- The manuscript is adequately structured. Nevertheless, textual revision is recommended, with particular attention to avoiding the use of words that imply a causal relationship.

Abstract

- Are the abstract and its Portuguese counterpart (resumo) adequate (including the objective, information about study participants, variables investigated, main results, and a conclusion) and do they accurately reflect the manuscript's content?
  Yes.
  Suggestions/comments:
- The abstract adequately presents the main components of the study, and the main statistical findings are clearly and precisely reported.

Introduction

- Is the research problem clearly stated and defined?
  Yes.
- Is the research problem adequately contextualized in relation to the existing body of knowledge, moving from general to specific?
  Yes.
- Are the reasons justifying the need for the study, including the authors' underlying assumptions about the problem, well established in the text?
  Yes.
- Are the references used to support the presentation of the research problem up to date and relevant to the topic?
  Yes.
- Is the objective clearly stated?
  Yes.
  Suggestions/comments:
- The Introduction provides a good contextualization of childhood obesity and the other variables of interest, demonstrating the scientific and social relevance of the study by focusing on schoolchildren from Quilombola communities, a historically vulnerable population that remains underrepresented in the literature.

Methods

- Are the methodological procedures generally appropriate for investigating the research problem?
  Yes.
- Are the methodological procedures used to conduct the study described in sufficient detail?
  Partially.
- Was the procedure used to select or recruit participants appropriate for the research problem and described sufficiently, clearly, and objectively?
  Yes.
- Is information provided about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, and validity), and, where applicable, the operational definitions of the variables?
  Yes.
- Is the data analysis plan appropriate and adequately described?
  Yes.
- Are the inclusion and/or exclusion criteria for study participants described and appropriate?
  Yes.
- Have the authors provided clarification regarding the ethical procedures adopted for the study?

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Partially.

Suggestions/comments:

- The study presents a methodological design appropriate to its stated objective, a robust sample with sample size calculations, and adequate sampling procedures. There is some repetition in the description of the sampling process in the Methods section. Revision is recommended on page 11, lines 14–23, and page 12, lines 1–9.
- Further details are needed regarding the format of the questions used to assess physical activity, particularly the visual features of the online Web-CAAFE questionnaire, which facilitate data collection in the age group assessed.
- The Methods section could be strengthened by providing a more detailed description of the data collection process, particularly regarding the arrangements and scheduling with the schools and the classes to be assessed. How were the visits and assessments scheduled with the schools? How was access to family members arranged to obtain information on sleep deprivation?
- Considering that screen exposure was assessed based on frequency of use, the authors should provide further details on how this frequency was measured.
- The assessment of physical activity also requires greater methodological clarity. Although the use of Web-CAAFE and the conversion of activities into MET values are reported, it is not sufficiently clear how the final variable represents the frequency with which the activities were performed.
- The final cut-off points used to categorize participants into quartiles were not reported for either physical activity or screen exposure. Although the results suggest high frequencies of these behaviors, the authors should provide a clearer explanation of how these variables were processed and categorized, including the final units of measurement used in the analyses. Without this information, readers would need prior knowledge of Web-CAAFE to fully understand the data.
- It is also recommended that the complete information regarding approval by the Research Ethics Committee be included in the revised manuscript, as these details are currently presented as XXXX. Although the text mentions ethical approval, the formal identification is incomplete.
- These observations do not undermine the methodological quality of the study, which is generally consistent and demonstrates appropriate scientific rigor.

Results

- Is the use of tables and figures appropriate and does it facilitate the clear presentation of the study results?
  Yes.
- Is the number of illustrations consistent with the journal's manuscript submission guidelines?
  Yes.
- Are the number of participants at each stage of the study, as well as the number and reasons for losses to follow-up and refusals, reported in the manuscript?
  Yes.
- Are the participants' characteristics presented and sufficiently described?
  Yes.
- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?
  Partially.

Suggestions/comments:

- The Results section is satisfactorily organized and presented, and the findings are consistent with the study objectives. The tables provide relevant information and facilitate understanding of the associations investigated. However, in Table 3, the prevalence ratio (PR) for the association between obesity and sleep deprivation among children is missing; only the confidence interval (CI) and p-value are presented.

Discussion

- Are the main findings of the study presented?
  Yes.
- Are the study's limitations and strengths presented and discussed?
  Yes.
- Are the results discussed in light of the study's limitations and the existing body of knowledge on the subject?
  Yes.
- Do the authors discuss the potential contributions of the main findings to scientific development, innovation, or real-world interventions?
  Yes.

Suggestions/comments:

- The Discussion demonstrates good integration with the national and international scientific lit-

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erature, particularly regarding childhood obesity, screen exposure, and sleep deprivation. The authors appropriately contextualize the findings.
- The absence of an association between physical activity and obesity warrants further interpretation in the text. It is recommended that the authors incorporate additional scientific references addressing this relationship into the existing Discussion. Statistically nonsignificant findings can also provide important insights for discussion, particularly when considering other variables and contextual factors that may influence the observed results.

Conclusion
- Is the study conclusion adequately presented and consistent with the study objective?
  Yes.
- Is the study conclusion original?
  Partially.
  Suggestions/comments:
- The Conclusion meets expectations for the closing section of the manuscript and addresses the research question. It is suggested that the authors explicitly mention the absence of a statistically significant association between physical activity and obesity, since this variable was part of the study's main objective.

References
- Are the references up to date and sufficient?
  Yes.
- Do original research articles account for the majority of the references?
  Yes.
- Do the references comply with the journal's guidelines regarding quantity and formatting?
  Partially.
- Are the in-text citations appropriate, that is, do the cited references substantiate the corresponding statements?
  Yes.
  Suggestions/comments:
- A final review of the reference formatting is recommended to ensure compliance with the journal's bibliographic guidelines, as there are inconsistencies in the formatting of journal names and publication dates.

Comments to the author
- This is a relevant scientific contribution, particularly with regard to the population investigated, considering that few studies have examined schoolchildren from rural Quilombola communities. Although the age group and variables of interest have already been investigated in studies involving schoolchildren from urban areas, this study addresses an underrepresented population. It is hoped that this research will stimulate further questions and analyses involving the population group studied.

Final decision
- Minor revisions required.

Reviewer B
Anonymous

Format
- Does the manuscript comply with the manuscript preparation guidelines for submission to the Brazilian Journal of Physical Activity and Health?
  Yes.
- Regarding formal aspects, is the manuscript well structured, containing the following sections: Introduction, Methods, Results, and Discussion (with the conclusion as part of the Discussion)?
  Yes.
- Is the language appropriate, and is the text clear, precise, and objective?
  Yes.
- Was any evidence of plagiarism identified in the manuscript?
  No.
  Suggestions/comments:
- None observed.

Abstract
- Are the abstract and its Portuguese counterpart (resumo) adequate (including the objective, information about study participants, variables investigated, main results, and a conclusion) and do they accurately reflect the manuscript's content?
  Yes.
  Suggestions/comments:
- Page 7, line 19: "no difference among schoolchildren." I did not understand this statement.

Introduction
- Is the research problem clearly stated and defined?
  Yes.

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- Is the research problem adequately contextualized in relation to the existing body of knowledge, moving from general to specific?
  Yes.
- Are the reasons justifying the need for the study, including the authors' underlying assumptions about the problem, well established in the text?
  Yes.
- Are the references used to support the presentation of the research problem up to date and relevant to the topic?
  Yes.
- Is the objective clearly stated?
  Yes.

Suggestions/comments:

- No comments.

Methods

- Are the methodological procedures generally appropriate for investigating the research problem?
  Yes.
- Are the methodological procedures used to conduct the study described in sufficient detail?
  Yes.
- Was the procedure used to select or recruit participants appropriate for the research problem and described sufficiently, clearly, and objectively?
  Yes.
- Is information provided about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, and validity), and, where applicable, the operational definitions of the variables?
  Yes.
- Is the data analysis plan appropriate and adequately described?
  Yes.
- Are the inclusion and/or exclusion criteria for study participants described and appropriate?
  Yes.
- Have the authors provided clarification regarding the ethical procedures adopted for the study?
  Partially.

Suggestions/comments:

- Page 12, line 15: The CAAE number assigned by the Research Ethics Committee is not provided.
- Pages 13, lines 1–7: The text is not aligned with the rest of the manuscript.

Results

- Is the use of tables and figures appropriate and does it facilitate the clear presentation of the study results?
  Yes.
- Is the number of illustrations consistent with the journal's manuscript submission guidelines?
  Yes.
- Are the number of participants at each stage of the study, as well as the number and reasons for losses to follow-up and refusals, reported in the manuscript?
  Yes.
- Are the participants' characteristics presented and sufficiently described?
  Yes.
- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?
  Yes.

Suggestions/comments:

- Pages 15, lines 11–12: "The overall prevalence of obesity was 8.4%, being higher among children than adolescents, but with no statistically significant difference." If the difference was not statistically significant, it is better not to state that the prevalence was higher. I suggest removing this statement.

Discussion

- Are the main findings of the study presented?
  Yes.
- Are the study's limitations and strengths presented and discussed?
  Yes.
- Are the results discussed in light of the study's limitations and the existing body of knowledge on the subject?
  Yes.
- Do the authors discuss the potential contributions of the main findings to scientific development, innovation, or real-world interventions?
  Yes.

Suggestions/comments:

- An interesting study that addresses gaps in the literature.

Conclusion

- Is the study conclusion adequately presented and consistent with the study objective?
  Yes.

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- Is the study conclusion original?
  Yes.
  Suggestions/comments:
- No comments.

References

- Are the references up to date and sufficient?
  Yes.
- Do original research articles account for the majority of the references?
  Yes.
- Do the references comply with the journal's guidelines regarding quantity and formatting?
  Yes.
- Are the in-text citations appropriate, that is, do the cited references substantiate the corresponding statements?
  Yes.
  Suggestions/comments:
- No comments.

Comments to the author

- An interesting and well-written study.
- A few suggestions:
- Page 7, line 19: "no difference among schoolchildren." I did not understand this statement.
- Page 12, line 15: The CAAE number assigned by the Research Ethics Committee is missing.
- Pages 13, lines 1–7: The text is not aligned with the rest of the manuscript.
- Pages 15, lines 11–12: "The overall prevalence of obesity was 8.4%, being higher among children than adolescents, but with no statistically significant difference." If the difference was not statistically significant, it is better not to state that the prevalence was higher. I suggest
- removing this statement.

Final decision

- Minor revisions required.

Reviewer C

Anonymous

Format

- Does the manuscript comply with the manuscript preparation guidelines for submission to the Brazilian Journal of Physical Activity and Health?
  Yes.
- Regarding formal aspects, is the manuscript well structured, containing the following sections: Introduction, Methods, Results, and Discussion (with the conclusion as part of the Discussion)?
  Yes.
- Is the language appropriate, and is the text clear, precise, and objective?
  Yes.
- Was any evidence of plagiarism identified in the manuscript?
  No.
  Suggestions/comments:
- The manuscript addresses an under investigated population and presents findings relevant to Public Health, Epidemiology, and Health Promotion. The Discussion is well grounded in the literature but could be strengthened through deeper interpretation, particularly regarding the absence of associations among adolescents, the role of physical activity, and the practical implications for public policies targeting Quilombola communities.
- The suggested revisions are specific and have the potential to substantially improve the scientific quality and impact of the manuscript.

Abstract

- Are the abstract and its Portuguese counterpart (resumo) adequate (including the objective, information about study participants, variables investigated, main results, and a conclusion) and do they accurately reflect the manuscript's content?
  Partially.
  Suggestions/comments:
- The age range defined in the Methods (10–12 years) directly contradicts the age range reported in the Abstract and tables (10–15 years). Furthermore, the criterion for sleep deprivation among adolescents is based on the Brazilian Society of Pediatrics' recommendation for individuals aged 13–18 years (less than 8 hours/day), but this age range is not included in the definition of "adolescents" provided in the Methods. The authors must define the age range precisely and consistently throughout all sections of the manuscript.
- The Portuguese abstract states that "obesity was associated with screen exposure and unhealthy food consumption," omitting the specific conclusion regarding sleep deprivation and children that appears in the English Abstract. Both abstracts must be

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equivalent in content.

Introduction

- Is the research problem clearly stated and defined?
  Yes.
- Is the research problem adequately contextualized in relation to the existing body of knowledge, moving from general to specific?
  Yes.
- Are the reasons justifying the need for the study, including the authors' underlying assumptions about the problem, well established in the text?
  Partially.
- Are the references used to support the presentation of the research problem up to date and relevant to the topic?
  Partially.
- Is the objective clearly stated?
  Yes.

Suggestions/comments:

- Review the cited reference and ensure that it supports the corresponding statement in the text, as indicated in the detailed comments.

Methods

- Are the methodological procedures generally appropriate for investigating the research problem?
  Yes.
- Are the methodological procedures used to conduct the study described in sufficient detail?
  Partially.
- Was the procedure used to select or recruit participants appropriate for the research problem and described sufficiently, clearly, and objectively?
  Partially.
- Is information provided about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, and validity), and, where applicable, the operational definitions of the variables?
  Partially.
- Is the data analysis plan appropriate and adequately described?
  Partially.
- Are the inclusion and/or exclusion criteria for study participants described and appropriate?
  Partially.
- Have the authors provided clarification regarding the ethical procedures adopted for the study?
  Partially.

Suggestions/comments:

- Insufficient description of the regression model
- The Methods section does not adequately describe how the Poisson regression models were constructed. Specifically, the authors need to indicate: (a) whether variable selection was based on a theoretical model (DAG) or a statistical criterion; (b) whether multicollinearity among independent variables was assessed; and (c) how physical activity was handled in the final model, given that it was not significantly associated with the outcome in the crude analysis.

Results

- Is the use of tables and figures appropriate and does it facilitate the clear presentation of the study results?
  Partially.
- Is the number of illustrations consistent with the journal's manuscript submission guidelines?
  Yes.
- Are the number of participants at each stage of the study, as well as the number and reasons for losses to follow-up and refusals, reported in the manuscript?
  Yes.
- Are the participants' characteristics presented and sufficiently described?
  Yes.
- Are the results adequately presented, highlighting the main findings and avoiding unnecessary repetition?
  Partially.

Suggestions/comments:

- The Results section is excessively brief given the number of analyses performed. The findings are reported in a telegraphic manner, without presenting the numerical values of the main associations directly in the text. It is recommended that the principal findings—particularly the prevalence ratios (PRs) and 95% confidence intervals (CIs) for statistically significant associations—be explicitly reported in the Results section rather than appearing only in the tables.

Discussion

- Are the main findings of the study presented?
  Partially.
- Are the study's limitations and strengths presented

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and discussed?
Partially.

- Are the results discussed in light of the study's limitations and the existing body of knowledge on the subject?
Partially.
- Do the authors discuss the potential contributions of the main findings to scientific development, innovation, or real-world interventions?
Partially.

Suggestions/comments:

- The Discussion is logically organized and engages appropriately with recent scientific literature, contextualizing the study's main findings. The authors relate their results to evidence from observational studies, systematic reviews, and meta-analyses, strengthening the plausibility of the observed associations between obesity, sleep deprivation, screen exposure, and unhealthy food consumption.
- A positive aspect is the specific contextualization of the Quilombola population, highlighting its social and health vulnerabilities. This lends originality to the manuscript and increases its relevance to Collective Health.

1. Discussion is overly descriptive
   - In several passages, the Discussion summarizes previous studies without sufficiently exploring the interpretation of the findings from the present investigation. It is recommended that the authors expand their critical analysis of the mechanisms that may explain why significant associations between obesity, sleep, and screen exposure were observed only among children, whereas these associations were not found among adolescents.
   - It would be useful to discuss possible differences related to developmental stage, behavioral autonomy, family influence, the school environment, or methodological factors (e.g., subgroup sample size).
2. Lack of discussion regarding physical activity
   - Considering that physical activity is included in the manuscript title and is one of the factors investigated, its limited representation in the Discussion is noteworthy.
   - If no statistically significant associations were indeed observed, the authors should explore possible explanations, such as:
     - Limitations of the instrument used to measure physical activity.
     - Limited variability in physical activity levels among participants.
     - The potential influence of other behavioral determinants.
     - Possible misclassification arising from the data collection method.
   - This discussion would help prevent readers from interpreting the absence of an association as evidence that physical activity is unimportant.
3. Integration of behavioral factors
   - Although each behavior is discussed separately, the manuscript could better explore the interactions among sleep, screen time, diet, and physical activity.
   - Contemporary health behavior models emphasize that these factors operate together across the 24-hour day (24-hour movement behaviors). This perspective would enrich the interpretation of the results and bring the study into closer alignment with the most recent international recommendations.
4. Public policies
   - The discussion of the National School Feeding Program (PNAE) is relevant but overly descriptive.
   - It is suggested that the authors more directly link their findings to potential intervention strategies targeting Quilombola communities, including:
     - Strengthening school meal programs.
     - Nutrition education initiatives.
     - Reducing screen exposure.
     - Promoting physical activity in school and community settings.
   - Family involvement.
   - This approach would increase the practical applicability of the findings.
5. Limitations
   - The limitations section is adequate but could include other important considerations:
   - Potential recall bias arising from self-reported data.
   - The possibility of reverse causality.
   - Lack of control for maturational or pubertal stage.
   - Absence of an objective assessment of screen time.
   - Potential influence of environmental factors specific to Quilombola communities.
   - These points would improve methodological transparency. Nevertheless, some aspects warrant further improvement.

Conclusion

- Is the study conclusion adequately presented and consistent with the study objective?
Partially.

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- Is the study conclusion original?
  Yes.
  Suggestions/comments:
- The Conclusion is consistent with the reported results and avoids inappropriate extrapolations.
- However, the authors should avoid overly prescriptive statements when these are derived from a cross-sectional study.
- For example, expressions such as "This could prevent sleep-wake disorders..." could be reformulated using more cautious language, such as "These strategies may contribute to reducing excessive screen exposure, improving sleep habits and promoting healthier lifestyles."
- Similarly, the authors should reinforce that the observed associations do not establish causal relationships, an issue already mentioned in the limitations.

References

- Are the references up to date and sufficient?
  Partially.
- Do original research articles account for the majority of the references?
  Yes.
- Do the references comply with the journal's guidelines regarding quantity and formatting?
  Yes.
- Are the in-text citations appropriate, that is, do the cited references substantiate the corresponding statements?
  Partially.
  Suggestions/comments:
- Reference 30 (Fang et al., 2020) is cited to support the statement that "among children with at least 2 hours/day of screen time, the odds of overweight/obesity are up to twice as high." However, checking the title and DOI of this reference (Obesity and immune status in children) indicates that it concerns obesity and immunity, not screen time. The authors should verify and correct this citation.

Comments to the author

1. Strengths

- The study deserves recognition for the following aspects:
- Originality and social relevance. According to the authors, this is the first study to simultaneously examine the associations among obesity, sleep deprivation, physical activity, screen exposure, and dietary intake in Brazilian Quilombola schoolchildren. This is a genuine contribution that aligns with health equity priorities on national and international scientific agendas.
- Sample size and quality. The probability-based, cluster-stratified sample of 1,007 participants from 12 rural Quilombola schools provides representativeness and statistical consistency. The refusal rate was very low (0.6%), strengthening the quality of the data.
- Contextually appropriate measurement instrument. The use of Web-CAAFE, previously validated in a Brazilian population, is appropriate for the age group studied and allows simultaneous assessment of physical activity, screen exposure, and dietary intake using a culturally relevant framework.
- Choice of statistical approach. The use of Poisson regression with robust variance to estimate prevalence ratios (PRs) is methodologically preferable to using odds ratios in cross-sectional studies with prevalent outcomes, demonstrating analytical rigor on the part of the authors.
- Connection with public policies. The discussion of the PNAE and its relationship with dietary habits among Quilombola schoolchildren is relevant, well contextualized, and represents a meaningful applied contribution for policymakers and educators.

2. Critical issues — mandatory corrections

- 2.1 Major inconsistency in the age range for adolescents
- This is the most serious inconsistency in the manuscript and recurs throughout the text. The authors define the age range for adolescents differently across sections:
  - English and Portuguese abstracts: adolescents = 10–15 years (page 5, line 11).
  - Methods section: adolescents = 10–12 years (page 10, line 17).
  - Table 1: adolescents = 10–15 years.
  - Tables 2 and 3: adolescents = 10–15 years.
- The definition used in the Methods (10–12 years) directly contradicts the definition presented in the abstracts and tables (10–15 years). Furthermore, the sleep deprivation criterion for adolescents is based on the Brazilian Society of Pediatrics' recommendation for individuals aged 13–18 years (less than 8 hours/day), but this age range is not included in the

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definition of "adolescents" provided in the Methods. The authors must define the age range precisely and consistently throughout all sections of the manuscript.

- 2.2 Missing value in Table 3 — PR column for sleep deprivation among children
- In Table 3, the cell corresponding to the adjusted PR for sleep deprivation in the children group is blank; only the 95% CI (1.07–4.05) is provided, without the point estimate for the PR. In the text (Abstract and Conclusion), the authors report a PR of 2.08 for this association, but this value does not appear in the table. This error compromises the transparency and reproducibility of the results and must be corrected.
- 2.3 Inconsistency in the 95% CI reported for the PR for sleep deprivation among children
- In the English Abstract, the PR for sleep deprivation among children is reported with a 95% CI of 1.07–4.05. The same CI appears in the adjusted analysis in Table 3. However, this value is not mentioned in the Portuguese abstract, where the conclusion is partially omitted. The authors must ensure that the Portuguese and English abstracts are identical in content.
- 2.4 Duplicated paragraph in the Methods
- The paragraph describing the four-stage sampling process appears twice consecutively in the Methods section, with minor wording differences. One of the two paragraphs should be removed.
- 2.5 Missing Research Ethics Committee identification number
- The CAAE number and the institution responsible for the Research Ethics Committee are listed as "XXXX" in the manuscript. Although this may have been an intentional blinding procedure for peer review, RBAFS requires this information to be included in the final version. The authors should confirm whether the omission was intentional or accidental.

3. Important methodological issues

- 3.1 No statistical power analysis for stratified outcomes
- The sample size calculation was based on the prevalence of overweight (19.87%), whereas the main outcome analyzed was obesity (prevalence of 8.4%). Furthermore, age-stratified analyses substantially reduce the sample sizes (children: n = 542; adolescents: n = 465). The authors do not discuss whether the study had sufficient statistical power to detect associations in the stratified analyses, particularly in the adolescent group, in which no significant associations were found. The absence of associations among adolescents may reflect insufficient statistical power rather than a true absence of associations, representing an important limitation that has not been addressed.
- 3.2 Criterion for screen exposure: frequency versus duration
- The authors acknowledge in the limitations that the study measures the daily frequency of screen use (number of episodes) rather than duration (total time in hours). This distinction is methodologically relevant and should be explored in greater depth, since international recommendations (WHO, AAP) use time in hours as the reference measure. The justification for using frequency as a proxy for duration needs to be more robustly supported, including citations to evidence validating this equivalence.
- 3.3 Sleep assessment based exclusively on parental reports
- Sleep deprivation was calculated based on parental reports of their children's bedtimes and wake-up times. The authors mention this potential bias in the limitations but do not adequately discuss its implications, particularly for adolescents, who tend to have greater autonomy over their schedules. It is recommended that this limitation be discussed in greater depth, including references on agreement between parental reports and actigraphy in this age group.
- 3.4 Insufficient description of the regression model
- The Methods section does not adequately describe how the Poisson regression models were constructed. Specifically, the authors need to indicate: (a) whether variable selection was based on a theoretical model (DAG) or a statistical criterion; (b) whether multicollinearity among independent variables was assessed; and (c) how physical activity was handled in the final model, given that it was not significantly associated with the outcome in the crude analysis.
- 3.5 Reference 30 is incompatible with the cited statement
- Reference 30 (Fang et al., 2020) is cited to support the statement that "among children with at least 2

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hours/day of screen time, the odds of overweight/obesity are up to twice as high." However, checking the title and DOI of this reference (Obesity and immune status in children) indicates that it concerns obesity and immunity, not screen time. The authors should verify and correct this citation.

4. Writing and clarity issues
- 4.1 Inconsistency between the abstract and the full text in the reporting of results
- The Portuguese abstract states that "obesity was associated with screen exposure and unhealthy food consumption" (page 8, line 1), omitting the specific conclusion regarding sleep deprivation and children that appears in the English Abstract. Both abstracts must be equivalent in content.
- 4.2 Incomplete presentation of results in the Results section
- The Results section is excessively brief given the number of analyses performed. The authors report findings in a telegraphic manner, without presenting the numerical values of the main associations directly in the text. It is recommended that the main findings—particularly the PRs and 95% CIs for statistically significant associations—be explicitly reported in the Results section rather than appearing only in the tables.
- 4.3 Inconsistent use of decimal separators in tables
- In Tables 2 and 3, some values use a comma as the decimal separator (e.g., 2,00; 1,00; 25,0; 26,0), whereas others use a period (e.g., 2.33; 1.64). Since the manuscript is written in English, the correct convention is to use a decimal point. The formatting should be standardized throughout.

5. Reference assessment
- The references are mostly up to date and relevant. However, in addition to the issue identified with reference 30 (item 4.5), the following points should be considered:
- Reference 19 (Lohman, Roche & Martorell, 1988) is a 1988 publication used as a standardization protocol for anthropometric measurements. Although it is a classic reference in the field, the authors should check whether a more recent edition or reference covering the same protocols is available.
- The manuscript cites 40 references, an appropriate number for the scope of the study and consistent with RBAFS guidelines.
- The reference formatting complies with the journal's requirements (Vancouver style with DOI).

6. Comments on tables and figure
- Table 1: Adequate and well structured. It is recommended that a row reporting p-values for comparisons between children and adolescents be added to facilitate interpretation.
- Table 3: In addition to the blank cell mentioned above (item 3.2), the missing Q1 reference category for the adolescent analysis of the screen exposure variable (the blank cell where "1.00" should appear) must be corrected.

Final decision
- Major revisions required.

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