Screen time and its association with adolescents' lifestyles in a city in the Brazilian Northeast

Tempo de tela e sua associação com estilo de vida dos adolescentes em um município do Nordeste brasileiro

El tiempo de pantalla y su asociación con el estilo de vida de los adolescentes de una ciudad del Nordeste brasileño

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Abstract
Objective: To associate screen time with food, physical activity, sleep and sociodemographic variables in Brazilian adolescents, students of urban public institutions. *Methods*: Observational, cross-sectional, quantitative, analytical study approved by the Ethics Committee in Research on Human Beings of the Federal University of Sergipe (CAAE 38981320.2.0000.5546) with students from 10 to 18 years of age at a public school in a municipality in the Brazilian Northeast. A descriptive analysis of screen time, sociodemographic, economic variables, academic year, physical activity, sleep duration and daytime sleepiness was performed. Fisher's exact test and Pearson's chi-square test were used to analyze the independence hypothesis and the Mann-Whitney test to assess the hypothesis of equality of the median of two samples, in addition to simple and multiple logistic regression. *Results*: 364 students participated in the study. The eighth and ninth year of elementary school; the first and second years of high school made more excessive use of electronic devices. There is a greater chance of screen time higher than recommended in those with a higher socioeconomic level. High screen time was associated with the presence of daytime sleepiness, with a higher prevalence of excessive screen time in students who considered they rarely and often had sleepiness. *Conclusions*: The prevalence of excessive screen time was higher in adolescents considered older, when compared to younger ones and in those with better socioeconomic conditions. It is possible that screen time influences shorter sleep duration and the presence of daytime sleepiness.
Keywords: Screen time; Adolescent; Life style; Feeding behavior; Sleep; Exercise.

Resumo
Objetivo: Associar o tempo de tela com alimentação, atividade física, sono e variáveis sociodemográficas em adolescentes brasileiros, estudantes de instituições públicas urbanas. *Métodos*: Estudo observacional, transversal, quantitativo, analítico aprovado pelo Comitê de Ética em Pesquisa em Seres Humanos da Universidade Federal de Sergipe (CAAE 38981320.2.0000.5546) com alunos de 10 a 18 anos de uma escola pública de um município no Nordeste brasileiro. Foi realizada uma análise descritiva do tempo de tela, variáveis sociodemográficas, econômicas, ano letivo, atividade física, duração do sono e sonolência diurna. O teste exato de Fisher e o teste qui-quadrado de Pearson foram utilizados para analisar a hipótese de independência e o teste de Mann-Whitney para avaliar a hipótese de igualdade da mediana de duas amostras, além de regressão logística simples e múltipla. *Resultados*: Participaram

do estudo 364 alunos. O oitavo e o nono ano do ensino fundamental; o primeiro e o segundo ano do ensino médio fizeram uso mais excessivo de aparelhos eletrônicos. Há maior chance de tempo de tela acima do recomendado naqueles com maior nível socioeconômico. O tempo elevado de tela foi associado à presença de sonolência diurna, com maior prevalência de tempo excessivo de tela em escolares que consideravam raramente e frequentemente tinham sonolência. *Conclusões*: A prevalência de tempo excessivo de tela foi maior em adolescentes considerados mais velhos, quando comparados aos mais jovens e naqueles com melhores condições socioeconômicas. É possível que o tempo de tela influencie na menor duração do sono e na presença de sonolência diurna.
Palavras-chave: Tempo de tela; Adolescente; Estilo de vida; Comportamento alimentar; Sono; Exercício físico.

Resumen
Objetivo: Asociar el tiempo de pantalla con la alimentación, la actividad física, el sueño y variables sociodemográficas en adolescentes brasileños, estudiantes de instituciones públicas urbanas. *Métodos*: Estudio observacional, transversal, cuantitativo, analítico aprobado por el Comité de Ética en Investigación con Seres Humanos de la Universidad Federal de Sergipe (CAAE 38981320.2.0000.5546) con estudiantes de 10 a 18 años de una escuela pública de un municipio en el Nordeste brasileño. Se realizó un análisis descriptivo del tiempo de pantalla, variables sociodemográficas, económicas, curso académico, actividad física, duración del sueño y somnolencia diurna. Se utilizó la prueba exacta de Fisher y la prueba chi-cuadrado de Pearson para analizar la hipótesis de independencia y la prueba de Mann-Whitney para evaluar la hipótesis de igualdad de la mediana de dos muestras, además de regresión logística simple y múltiple. *Resultados*: 364 estudiantes participaron en el estudio. El octavo y noveno año de la escuela primaria; los de primero y segundo de secundaria hacían un uso más excesivo de los dispositivos electrónicos. Hay una mayor probabilidad de tiempo de pantalla superior al recomendado en aquellos con un nivel socioeconómico más alto. El tiempo de pantalla elevado se asoció con la presencia de somnolencia diurna, con una mayor prevalencia de tiempo de pantalla excesivo en los estudiantes que consideraron que rara vez y con frecuencia tenían somnolencia. *Conclusiones*: La prevalencia de tiempo excesivo frente a la pantalla fue mayor en los adolescentes considerados de mayor edad, en comparación con los más jóvenes y con mejores condiciones socioeconómicas. Es posible que el tiempo de pantalla influya en la menor duración del sueño y la presencia de somnolencia diurna.
Palabras clave: Tiempo de pantalla; Adolescente; Estilo de vida; Conducta alimentaria; Sueño; Ejercicio físico.

1. Introduction

In the current scenario of globalization, modernization of technological means and changes in personal relationships and entertainment, the increase in screen time is notorious (Guedes et al., 2018). In Brazil, 93% of children and adolescents between 9 and 17 years old use cell phones (Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação, 2018). The Northeast was the region with the lowest prevalence of excessive screen time in teenagers (Schaan et al., 2019), in Sergipe, the prevalence of excessive television time was 70.9% for girls and 66.2% for boys aged 13 to 18 years old (Silva et al., 2014).

The transition from childhood to adolescence, there is a greater use of media and access by increasingly early ages, with the exception that this involvement depending on culture and behavioral traditions (Gonçalves et al., 2007; Schaan et al., 2019). A exposure to screen devices is considered the most sedentary behavior predominant with negative consequences on body composition, physical fitness, metabolic and cardiovascular risk factors, self-esteem, behavioral conduct, social behavior, length of sleep and academic performance (Schaan et al., 2019; Silva et al., 2014).

Given this situation and the increased prevalence of screen exposure among teenagers, it is relevant to analyze this habit in one of the regions that presented one of the lowest overuse rates. Therefore, the aim of this study was to understand the association of screen with eating behavior, physical activity, sleep and sociodemographic variables in adolescents in a city in Brazilian Northeast. Based on the results found, it would be possible to expand the literature data and establish interventions in an attempt to reduce the exposure time, to mitigate negative outcomes in adolescents.

2. Methodology

This is an observational, cross-sectional, quantitative, analytical study, approved by the Ethics Committee in Research on Human Beings of the Federal University of Sergipe (CAAE 38981320.2.0000.5546). The population is made up of 900

students, 250 of which are elementary school students and 750 high school students, enrolled in morning and afternoon shifts in urban public schools located in the Centro de Lagarto neighborhood in Sergipe.

To compose the sample of this research, adolescents aged between 10 and 18 years, enrolled in the selected educational institutions, regardless of sex, nutritional status, race or socioeconomic level, who attended morning or afternoon classes. Participants showed agreement with the research by signing the Free and Informed Assent Term (TALE) and obtained authorization of the person in charge, based on the Free and Informed Consent Term (TCLE). Those with some degree of intellectual disability that made it difficult to complete the questionnaire or with any type of physical disability that could interfere with screen use were excluded from the research.

Due to the current epidemiological scenario of the pandemic caused by the SARS-CoV 2 coronavirus agent, for data collection, researchers were present in schools during March to September 2021, so that TCLE was delivered to those responsible, they provided the TALE and the questionnaire to the student.

The semi-structured questionnaire with questions related to screen time was evaluated using the methodology recommended by the "Global School-based Student Health Survey (GSHS)" (Centers for Disease Control and Prevention, 2015), an instrument already used in other national surveys to assess lifestyle and health risk behaviors in adolescents (Grupo de Pesquisa em Estilos de Vida Saúde, 2016; Instituto Brasileiro de Geografia e Estatística, 2015). The evaluation of smartphone and tablet handling was separated by the fact that the cell phone is one of the most used equipment and the data regarding its use, in isolation, are little described in the literature (Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação, 2018).

The answers were analyzed from the weighted average of the time of use of each equipment in a week. Students who reported use equal to and/or greater than two hours per day, both for a specific device and for the sum of the total time, categorized as having excessive screen time (Eisenstein et al., 2019; Tremblay et al., 2011).

The sociodemographic variables were age in complete years, sex and grade/school year. The economic aspect was evaluated through the stratification of the Brazil Criterion, representing the order of purchasing power (Associação Brasileira de Empresas de Pesquisa, 2019).

In the evaluation of eating habits, the consumption of fruits and vegetables was analyzed based on the frequency of daily portions in a week (Grupo de Pesquisa em Estilos de Vida Saúde, 2016; Instituto Brasileiro de Geografia e Estatística, 2015). Students who reported consuming fruits and vegetables for five or more days in a week received the classification of adequate consumption. If consumption was lower, it was defined as inadequate (Instituto Brasileiro de Geografia e Estatística, 2015).

The level of physical activity was assessed of the GSHS questionnaire (Grupo de Pesquisa em Estilos de Vida Saúde, 2016; Instituto Brasileiro de Geografia e Estatística, 2015). Those who totaled a time greater than or equal to 60 minutes performing the questioned activities for at least five days were considered physically active. Responses with a shorter period, insufficiently active (Bull et al., 2020).

The questionnaire also addressed aspects of sleep in the last month. Regarding sleep duration, responses were categorized according to age into very short sleep, short sleep, recommended sleep, and long sleep (Galland et al., 2018). The subjective quality of sleep was established as very low, low, good or very good. Another item analyzed was the presence of daytime sleepiness (Munezawa et al., 2011).

Categorical variables (food, physical activity and sleep) were described using absolute frequency and percentage relative, the hypothesis of independence between variables was tested using Fisher's Exact and Pearson's Chi-Square. The continuous variables (screen time, sociodemographics and economic) were described as mean, median, standard deviation and interquartile range. The Mann-Whitney test was applied to evaluate the hypothesis of equality the median of two samples.

Gross and adjusted odds ratios and their respective confidence intervals through the simple and multiple logistic regression model. The inclusion of variables in the model required: hypothesis test with p-value less than 0.2, absence of separation phenomena (zero boxes) and percentage of absentees lower than 10%. The level of significance adopted was 5% and the software used was R Core Team 2021 (Version 4.1.0).

3. Results

The 364 students participated in the study, 204 from the middle school and 160 of elementary school II, aged between ten and eighteen years old. Between them, 64.3% (n=234) were female and 35.7% (n=130) were male and most classified their color as brown (56%), followed by white (29.7%), black (10.2%), yellow (3.0%) and indigenous (1.1%). The distribution of the students' economic classes were: A=1.9%, B1=8.0%, B2=23.9%, C1=21.2%, C2=27.5% and D and E=17.6%.

Table 01 depicts the descriptive analysis according to age, points for class classification economic, classification of the total time of exposure to screens per week, eating behavior, physical activity, duration and quality of sleep.

Table 1 - Distribution of dependent and independent variables.

	n	%	Median	IIQ
Age			15,0	13-16
Points for class classification economic			24,0	18-31
Total screen time			5,4	3,9-7,1
Excessive screen time	337	92,6		
Proper use	27	7,4		
Eating Habits				
Inappropriate	217	59,6		
Healthy	147	40,4		
Physical Activity				
Insufficiently active	277	76,1		
Physicalle active	87	23,9		
Daily hours of sleep				
Less than 6h	38	10,4		
6 a 7h	96	26,4		
7 a 8h	110	30,2		
8 a 9h	54	14,8		
9 a 10h	34	9,3		
10 a 11h	16	4,4		
More than 11h	16	4,4		
Duration of sleep				
Very short	39	10,7		
Short term	209	57,4		
Long term	18	4,9		
Recommended	98	26,9		
Quality of sleep				
Too bad	29	8,0		
Bad	62	17,0		
Good	191	52,5		
Very good	82	22,5		
Daytime sleepiness				
Never	26	7,1		
Rarely	84	23,1		
Sometimes	177	48,6		
Often	45	12,4		
Ever	32	8,8		

n – absolute frequency. % – percentage relative frequency. IIQ – Interquartile Range. Source: Authors.

Graphs 1 and 2 detail the usage time of each of the four screen-based media evaluated, according to the weighted average of the time spent from Monday to Friday and on the weekend, respectively.

Graph 1 - Association of relative frequency with time of use of electronic devices on working days.
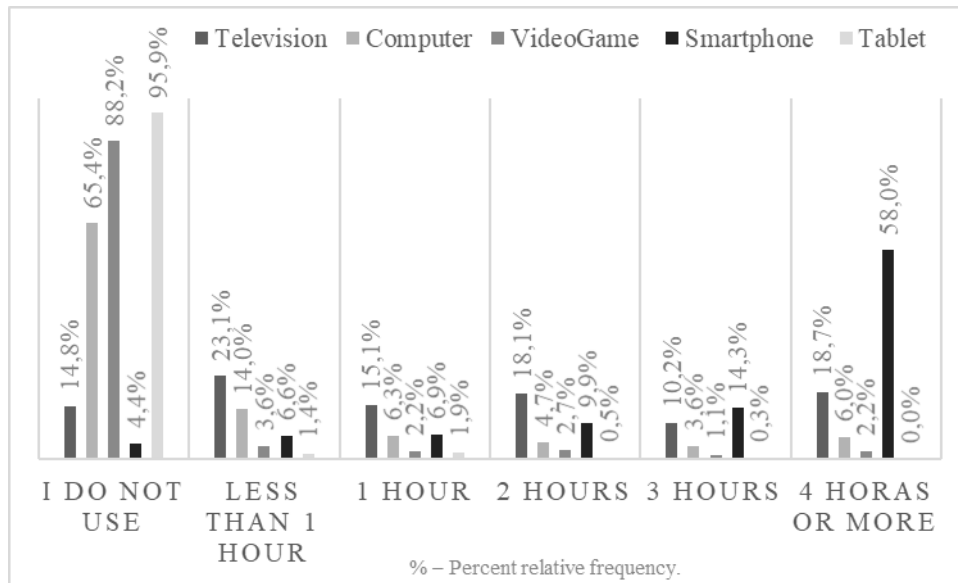
Source: Authors.

Graph 2 - Association of relative frequency with time of use of electronic devices on weekends.
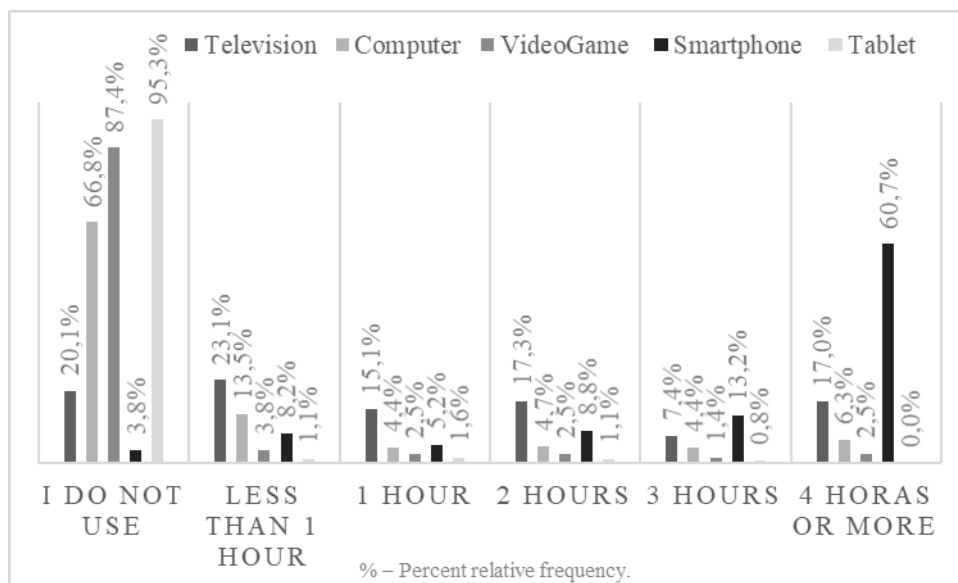
Source: Authors.

Table 2 depicts the relationship between excessive time and adequate screen use, defined from the evaluation of the average weight of use in a week, with the sociodemographic variables and independent. High screen time was associated with the presence of daytime sleepiness ($p<0.05$). In addition, the academic year, economic classification, number of hours of sleep per day and sleepiness daytime were included in the regression model presented in Table 3.

Table 2 - Relationship of screen time with sociodemographic and independent variables.

	Total Screen Time Rating		
	Excessive screen time	Proper use	p-value
Age, *Median (IIQ)*	15 (14-16)	14 (13-16)	0,080 M
Sex, *n (%)*			
Feminine	215 (63,8)	19 (70,4)	0,539 F
Male	122 (36,2)	8 (29,6)	
Rade/academic year, *n (%)*			
6th year	26 (7,7)	3 (11,1)	**0,129** Q
7th year	31 (9,2)	4 (14,8)	
8th year	32 (9,5)	4 (14,8)	
9th year	47 (13,9)	2 (7,4)	
1st year of high school	91 (27)	7 (25,9)	
2nd year of high school	50 (14,8)	2 (7,4)	
3rd year of high school	52 (15,4)	2 (7,4)	
Color/Race, *n (%)*			
White	100 (29,7)	8 (29,6)	0,484 Q
Black	32 (9,5)	5 (18,5)	
Brown	190 (56,4)	14 (51,9)	
Yellow	11 (3,3)	0 (0)	
Indigenous	4 (1,2)	0 (0)	
Points for class classification economic, *Median (IIQ)*	24 (19-31)	20 (15-26)	0,028 M
Classification economic, *n (%)*			**0,130** Q
Eating Habits, *n (%)*			
Inappropriate	205 (60,8)	12 (44,4)	0,106 F
Healthy	132 (39,2)	15 (55,6)	
Physical Activity, *n (%)*			
Insufficiently active	256 (76)	21 (77,8)	1,000 F
Physicalle active	81 (24)	6 (22,2)	
Daily hours of sleep, *n (%)*			
Less than 6h	37 (11)	1 (3,7)	**0,195** Q
6 a 7h	84 (24,9)	12 (44,4)	
7 a 8h	105 (31,2)	5 (18,5)	
8 a 9h	50 (14,8)	4 (14,8)	
9 a 10h	30 (8,9)	4 (14,8)	
10 a 11h	16 (4,7)	0 (0)	
More than 11h	15 (4,5)	1 (3,7)	
Duration of sleep, *n (%)*			
Very short	36 (10,7)	3 (11,1)	1,000 Q
Shor term	193 (57,3)	16 (59,3)	
Long term	17 (5)	1 (3,7)	
Recommended	91 (27)	7 (25,9)	
Quality of sleep, *n (%)*			
Too bad	28 (8,3)	1 (3,7)	0,367 Q
Bad	60 (17,8)	2 (7,4)	
Good	175 (51,9)	16 (59,3)	
Very Good	74 (22)	8 (29,6)	
Daytime sleepiness, *n (%)*			
Never	21 (6,2)	5 (18,5)	**0,028** Q
Rarely	81 (24)	3 (11,1)	
Sometimes	160 (47,5)	17 (63)	
Often	44 (13,1)	1 (3,7)	
Ever	31 (9,2)	1 (3,7)	

n – absolute frequency. % – percentage relative frequency. IIQ – Interquartile Range. M – Mann-Whitney test. F – Fisher's Exact test. Q – Pearson's Qui-Square test. Bold indicates p<0,2. Source: Authors.

Table 3 shows the highest probability of the ninth year (RC 8.81 [1.27-61.32]) of teaching fundamental II, as well as the first (RC 4.88 [1.05-22.59]), second (RC 9.37 [1.35-65.15]) and third year (RC 9.75 [1.40-67.7]) of high school make excessive use of electronic devices. The highest chance of screen time higher than recommended for age was also observed in the group with the highest scores in the economic classification compared to those with the lowest sum (RC 1.06 [1.01-1.11] and IIQ 24 [19-31]). Students who rarely (RC 6.43 [1.42-29.09]) and often (OR 10.48 [1.15-95.41]) having daytime sleepiness are most likely to overuse screen devices in comparison that never have the drowsiness.

Table 3 - Analysis between screen time and sociodemographic and independent variables.

	Total Screen Time Rating			
	RC (IC95%)	p-value	RCa (IC95%)	p-value
Rade/academic year				
6th year	1			
7th year	2,91 (0,54-15,70)	0,215		
8th year	3,00 (0,56-16,19)	0,201		
9th year	8,81 (1,27-61,32)	**0,028**		
1st year of high school	4,88 (1,05-22,59)	**0,043**		
2nd year of high school	9,37 (1,35-65,15)	**0,024**		
3rd year of high school	9,75 (1,40-67,7)	**0,021**		
Points for class classification economic	1,06 (1,01-1,11)	**0,026**	1,06 (1,01-1,11)	0,026
Eating Habits				
Inappropriate	1,94 (0,88-4,28)	0,100		
Healthy	1			
Physical Activity	1,16 (0,97-1,39)	0,097		
Daytime sleepiness				
Never	1			
Rarely	6,43 (1,42-29,09)	**0,016**		
Sometimes	2,24 (0,75-6,71)	0,149		
Often	10,48 (1,15-95,41)	**0,037**		
Ever	7,38 (0,80-67,78)	0,077		

RC – Odds Ratio. IC95% – 95% confidence interval. Bold indicates p<0,05. Source: Authors.

4. Discussion

The present study showed a high prevalence of excessive screen time in both sexes, highlighting the use of smartphones by more than half of the interviewees, which corroborates with Brazilian studies (Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação, 2018; Instituto Brasileiro de Geografia e Estatística, 2015; Piola et al., 2020; Schaan et al., 2019; Silva et al., 2014). There is a direct influence of the relationship between peers in the sedentary habit (Guedes et al., 2018; Piola et al., 2020). The pandemic of the disease caused by the new coronavirus (COVID-19) also interferes in this scenario, since there was screen time higher than recommended in large part of Brazilian adolescents, faced with confinement, restrictions on activities and the search for a new way of entertainment and socialization (Teixeira et al., 2021).

Exposure to screens for more than two hours a day was associated with higher socioeconomic status. Similar data were demonstrated in a study carried out in Brazilian, in which children with higher incomes were 3.5 times more likely to have more screen time, compared to the others (Nobre et al., 2021). It is possible that families with higher purchasing power facilitate access to different technologies considered leisure options and means of promoting learning, interaction and qualification (Nobre et al., 2021).

However, an inverse relationship was analyzed in Berlin, since adolescents with middle and low socioeconomic groups, showed a greater chance of excessive screen time compared to those belonging to the strata superiors of the economic classification, which were subjected to more restrictive rules regarding the use of screens for longer parenteral awareness of the harmful effects of exacerbated use (Tandon et al., 2012). It is worth remembering that Germany has a very high HDI, so the social support offered differentiates compared to the Brazilian Northeast, with an average HDI, a fact that may also influence the findings reported.

When comparing screen time between academic years, there was a greater chance of using higher than recommended for electronic devices by the ninth grade of elementary school II, first, second and third year of high school. Young people represent the target group of the entertainment market, which through technologies promote activation of the reward system, sudden escape from disturbing emotions, obtaining employment and income, in addition to the psychological and physical arousal that cause the craving to become compulsion (Guerrero et al., 2019; Riera et al., 2019). This, associated with the

physiological characteristics of adolescence, favors the occurrence of behavioral and mood changes, less self-control, difficulty in interpersonal relationships, decreased academic performance, sleep problems and digital addiction (Hale & Guan, 2015; Twenge & Campbell, 2018).

Most participants reported having short sleep duration and high screen time associated with daytime sleepiness, especially among those who considered sleepiness rarely and frequente. Similarly, in Spain, using a allowed use of cell phone caused worse sleep quality (Riera et al., 2019). The delay in bedtime and the reduction in total sleep time were associated with the night period, which suggests the impact of the negative light of technological devices on sleep homeostasis (Hale & Guan, 2015).

The inverse relationship between screen time and sleep duration can compromise performance academic. It is observed that there is a reduction in the mechanisms necessary for brain maturation, daytime sleepiness, sleep problems, memory, lower psychological well-being and impact on stimulus processing and concentration (Guerrero et al., 2019; Hale & Guan, 2015; Instituto Brasileiro de Geografia e Estatística, 2015). Short sleep duration also may be associated with obesity and cardiometabolic risk factors due to circadian misalignment of the appetite, change in meal times and greater food consumption at night (Seo & Shim, 2019).

The high prevalence of inadequate food and the short time devoted to physical activity were verified in adolescents with excessive use of screens (Instituto Brasileiro de Geografia e Estatística, 2015; Silva et al., 2014). However, in this study, use of screens was not associated with dietary habits and activity physical, appear to be independent factors.

It is important to address the limitations of this study. For data collection, we used self-report questionnaire, which allows for greater detailing of the data and is a form used in epidemiological studies. However, accuracy can be compromised when using the method recall and by questioning socioeconomic data and health risk behaviors, which may stimulate change in response to what actually occurs. As this is an extensive questionnaire, it may have had less careful reading and unreliable answers. The questionnaire did not show the alternative "does not have", when questioned about the use of each electronic device, a fact that differs from do not use. In addition, as it is a cross-sectional study, it is not possible to confirm the relationships of cause and effect found, with only associations being suggested. The study sample is not representative of all teenagers in the city and did not include students from rural schools, however, it encompassed schools with the highest number of students from elementary school II and high school. Finally, the study was carried out during the coronavirus pandemic, a period in which confinement may have interfered in the increase in sedentary behaviors and in encouraging the use of screens for longer prolonged than usual, which perhaps did not reflect the habits prior to that event.

5. Conclusion

In conclusion, in this study, there was a high prevalence of excess screen time, especially in those with older age in the sample and with better socioeconomic conditions. The findings suggest an influence of screen use on sleep quality by verifying a correlation with shorter sleep duration and daytime sleepiness, which culminates in an unhealthy and inappropriate lifestyle for the physiological development. Thus, public health authorities in partnership with the schools could, from these data, develop interventions aimed at health education in the attempt to reduce the time exposed and the negative outcomes of this habit. Finally, longitudinal studies and more research with similar and more comprehensive methodological procedures in other schools and cities become necessary in order to confirm the results in the Brazilian context.

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