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Original Article

Food Consumption and Sleep Disturbances in 9-year-old Children

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Abstract

Objective To assess the association of food consumption with sleep disturbances in 9-year-old children.

Material and Methods The present study is part of a larger cohort study named Predictors of Maternal and Infant Excess Body Weight (PREDI) that was conducted in the homes of the participants during the fourth study follow-up. Anthropometric assessment and demographic, socioeconomic, food consumption, and sleep data were obtained. The children's food consumption was evaluated using the Brazilian Food and Nutrition Surveillance System (SISVAN, in the Portuguese acronym). Sleep habits were assessed using the Sleep Disturbance Scale for Children to evaluate sleep pattern-related behaviors in children/adolescents aged 3 to 18 years. Data were self-reported by the mother and her child on the day of the visit. Logistic regression analysis was used to estimate the association of food consumption with sleep disturbances in children at 9 years of age.

Results Of the 142 children who participated in the study, 45.1% had sleep disturbances; most of them were boys (53.6%). The proportion of children with sleep disturbances was higher (55.6%) among children who did not consume fruits compared with those who ate fruits ($p = 0.008$). Logistic regression analysis revealed that the lack of fruit consumption was associated with sleep disturbances (OR = 2.26, $p = 0.023$), even after adjustment for other predictors.

Conclusion We showed that the lack of fruit consumption is a predictor of sleep disturbances. Since fruit consumption had a protective effect on sleep disturbances at 9 years of age, encouraging the consumption of fiber-rich foods may contribute to preventing the establishment of sleep problems even in infants.

Keywords
- children
- sleep habits
- sleep disturbance
- food consumption
- fruits

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Introduction

Quality sleep, a balanced diet, and regular physical activity are essential conditions for a healthy life.[1] Unfortunately, an increase in sleep problems has been observed over the past 20 years, including difficulty falling asleep, waking up during the night, and sleep disturbances.[2,3] This is an important fact since an inadequate sleep pattern is associated with many problems, such as diabetes, hypertension, stroke, hormonal alterations, cancer, immune system disorders, and compromised mental and emotional health.[2]

Sleep disturbances are common in children and adolescents and are characterized as an insufficient amount of sleep, excessive sleep, or unusual movements during sleep.[3] Unfortunately, the condition continues to be unrecognized and undertreated.[3] The most prevalent sleep disorders are those associated with the maturation of sleep mechanisms, such as partial awakenings (sleepwalking, night terrors, confusional awakenings), obstructive respiratory disorders (snoring, apneas), sleep-related epilepsies (Rolandic epilepsy, hypermotor sleep epilepsy), and movement disorders (restless legs syndrome, periodic limb movements, restless sleep disorder, bruxism). Several factors contribute to sleep pattern alterations in children, such as metabolic syndromes, growth hormone deficiency, allergic conditions, blood malignancies, and obesity.[2] In addition, some authors have shown that eating habits are also associated with sleep problems in children and adolescents.[4,5] A lower consumption of fruits and vegetables combined with higher consumption of fast food and energy-rich and nutrient-poor foods are predictors of sleep disturbances.[4,5]

Food consumption has changed drastically over the past 20 years in Brazil and worldwide,[6] with a change in the consumption of fresh foods and minimally processed foods such as rice, legumes (pulses), vegetables, and fresh fruits to the consumption of industrialized and ready-to-consume ultra-processed foods.[7] The drastic change in adult eating habits has also affected children's eating behavior, creating a vicious cycle with harmful medium- and long-term consequences for the population.[8] As a result, there has been a significant reduction in the consumption of foods rich in antioxidants in both adults and children. These foods are essential for the functioning of the body[9] and can contribute considerably to reducing or avoiding sleep disturbances.[10] Studies investigating the relationship between food consumption and sleep problems are important to understand its effect on health, especially in children, and new scientific information on this topic is needed. Therefore, the objective of this study was to evaluate the association of food consumption with sleep habits in 9-year-old Brazilian children.

Material and Methods

Study Design, Settings, and Participants

Data were obtained from the Predictors of Maternal and Infant Excess Body Weight – PREDI study, a cohort study performed in Joinville, Santa Catarina, Brazil, to examine the predictors of maternal and child excess body weight over the years.

This is a cross-sectional study that used data from adult women and their children after 9 years of follow-up (baseline, 2012; 4th follow-up, 2021). Details of the recruitment process have been described previously.[11] In summary, women older than 18 years giving birth to a full-term singleton (37–42 weeks of gestation) were invited to participate in the study with their newborns in the period from January to February 2012. Baseline exclusion criteria were preeclampsia, presence of an infectious contagious disease (AIDS, hepatitis, syphilis, and toxoplasmosis), birth defects, and plans for adoption immediately after delivery.

The Research Ethics Committee of the University of Joinville Region approved the study (Protocols No. 107/2011 and 4.478.870/2021), and all participants gave their informed consent prior to inclusion in the study.

Data Collection

Demographic, socioeconomic, food consumption, sleep, anthropometric, and clinical data were collected in the family's home during the fourth follow-up using a structured questionnaire. A group of trained health researchers collected the data. Mothers who had participated in the previous follow-up (3rd) were contacted by phone 1 to 2 weeks before data collection and were invited to participate in the present study. When there was no response by phone, the participants were invited in person. If the participant was not located even after visiting the residence, new attempts were made such as contacting neighbors and nearby commercial establishments as well as through social media. After exclusions and losses, 144 pairs continued to participate in the 4th follow-up (►**Fig. 1**), but 2 caregivers were unable to inform the child's sleep data.

The data were collected individually in a room of the family's home using a tested structured questionnaire. The variables included were age, education, marital status, and monthly household income for mothers, and school period, sex, body mass index (BMI), food consumption, and sleep habits for children.

Weight was measured to the nearest 0.1 kg using a digital scale with a capacity of 180 kg (Glass 7, G-Tech, Zhongshan, China). Height was measured to the nearest 0.1 cm with a portable ultrasonic digital stadiometer (CAVA-040, AvaNutri, Rio de Janeiro, Brazil). The children's weight status was based on the 2007 World Health Organization (WHO)[12] growth standards for BMI-for-age for children and adolescents aged 5 to 19 years. A BMI $> 85^{th}$ percentile was classified as excess body weight.

Food Consumption

Food consumption was assessed using the Food Consumption Marker Form of the Food and Nutrition Surveillance System (Sistema de Vigilância Alimentar e Nutricional – SISVAN).[13] The form was designed by the Brazilian Ministry of Health to monitor the nutritional status and food intake characteristics of individuals receiving care within the Public Health System (Sistema Único de Saúde – SUS).[13] The form is divided into 3 categories: 1) children under 6 months, 2) children from 6 months to 23 months and 29 days, and 3)

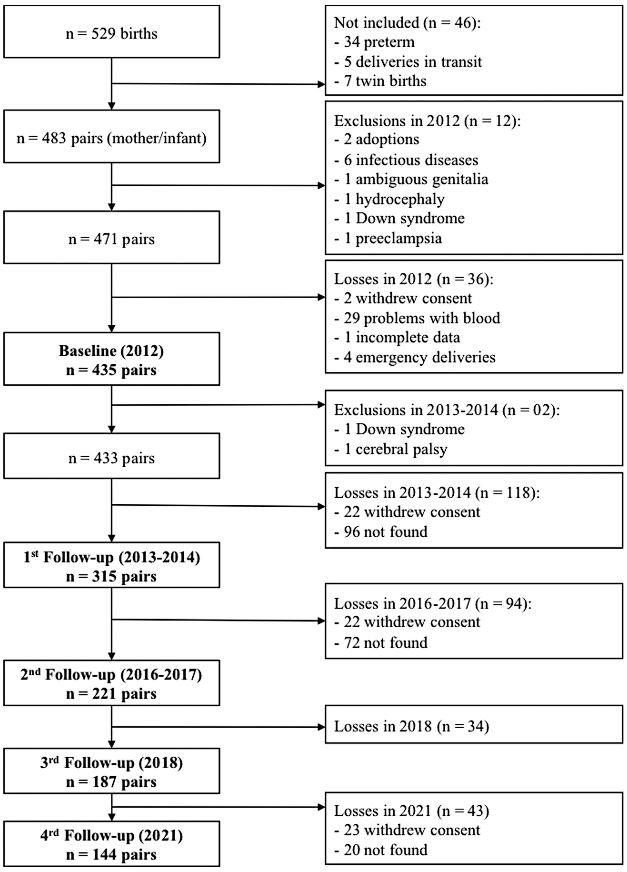

Fig. 1 Flow diagram of the Predictors of Maternal and Infant Excess Body Weight (PREDI) study, Joinville, Brazil, 2012–2021.

children aged 2 years or older, teenagers, adults, older adults, and pregnant women.[13] The third group includes food consumption markers based on the Food Guide for the Brazilian population.[13]

The food consumption markers were established based on the child's food consumption of the previous day reported by the participant on the day of the team's visit.[13] For each of the seven food groups investigated, the participant could answer *yes*, *no*, or *do not know* for the consumption of: 1) legumes (pulses), 2) fresh fruits (not fruit juices), 3) vegetables and/or legumes (not including potatoes, cassava and yam), 4) hamburgers and/or processed meats (ham, mortadella, salami, sausages), 5) soft drinks (soda, box juices, powdered juices, coconut water, guarana/currant syrups, fruit juice with added sugar), 6) noodles, packaged snacks or savory cookies, and 7) creme-filled sandwich cookies, sweets and treats (candies, lollipops, gum, caramel, gelatin).[13] None of the participants answered *do not know* for the consumption of any of the seven items assessed. The form takes ~ 5 minutes to complete.

Sleep Habits

The sleep habit was investigated based on the child's sleep behavior in the past 6 months reported by the mother/caregiver on the day of the visit using the Sleep Disturbance Scale for Children (SDSC), which takes ~ 5 to 10 minutes to complete. The instrument was developed to assess sleep pattern-related behaviors in children and adolescents aged 3 to 18 years[14] and was translated and validated into Brazilian Portuguese. The SDSC consists of 26-item divided into 6 subscales, distinguishing between transient behavior and permanent behavior.[15] Item 1: measures the child's average hours of sleep from 1 (9–11 hours) to 5 (< 5 hours). Item 2: measures the child's average time to fall asleep from 1 (less than 15 minutes) to 5 (more than 60 minutes). The remaining 24 items were scored on a Likert-type scale from 1 to 5 (1 = never, 2 = 1–2 times/month, 3 = 1–2 times/week, 4 = 3–5 times/week, and 5 = always/daily).[15] The higher the final score the worse the sleep quality, and the minimum and maximum total scores of the instrument were 26 and 130, respectively.[15] The cutoff score established for the classification of sleep disturbances was 39. The SDSC has demonstrated acceptable internal reliability for total sleep score ($\alpha = 0.55$) and subscale scores ($\alpha = 0.56–0.82$).[15]

Each sleep disorder consists of more than one item[15]: I. Disorders of initiating and maintaining sleep: formed by sleep duration (item 1), sleep latency (item 2), going to bed without reluctance (item 3), difficulty falling asleep at night (item 4), falling asleep without anxiety (item 5), nocturnal awakenings (item 10), and after waking up in the night, the child has difficulty to fall asleep (item 11). II. Sleep-disordered breathing: breathing difficulties (item 13), sleep apnea (item 14), and snoring (item 15). III. Disorders of arousal: sleepwalking (item 17), night terrors (item 20), and nightmares (item 21). IV. Sleep-wake transition disorders: hypnic jerks (item 6), rhythmic movement disturbances (item 7), hypnagogic hallucinations (item 8), nocturnal movements (item 12), talking in his/her sleep (item 18), and bruxism (item 19). V. Disorders of excessive somnolence: difficulty waking up (item 22), waking up tired (item 23), sleep paralysis (item 24), daytime sleepiness (item 25), and falling asleep suddenly in inappropriate situations (item 26). VI. Sleep hyperhidrosis: falling asleep sweaty (item 9) and sweating excessively during the night (item 16).

Statistical Analysis

The IBM SPSS Statistics for Macintosh software, version 29.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. Differences between the mother-child pairs who were lost to follow-up, and those enrolled in the 4th follow-up ($n = 142$) were obtained by comparing the variables maternal age, maternal education (years), monthly household income, birth weight, marital status, and child's sex using the Mann-Whitney U test and the chi-square test.

We performed posthoc logistic regression to calculate the power achieved assuming an α error of 5%, two tails, odds ratio (OR) of 2.5, and a total sample size of 142 individuals. Considering these parameters, the sample size achieved a power > 72%. The calculation was performed using the G*Power software (version 3.1.9.6).

The chi-square test was applied to compare the proportion of categorical variables according to the presence (yes) or absence (no) of sleep disturbances (►**Table 1**). The OR and 95% confidence intervals (CI) were calculated using logistic regression analysis to investigate the association of food consumption with the total sleep disturbance score and other important predictors. Each predictor was examined individually in Model 1, and

Table 1 Characteristics of the study participants according to the presence and absence of sleep disturbances ($n = 142$). The PREDI Study, Joinville, Brazil, 2021.

Characteristic	Sleep disturbance			*P*-value*
	No (54.9%)	Yes (45.1%)	Total (100.0%)	
	n (%)	n (%)	n (%)	
Mother				
Age (years)				0.244
< 30	6 (85.7)	1 (14.3)	7 (4.9)	
30–40	42 (53.2)	37 (46.8)	79 (55.7)	
≥ 40	30 (53.6)	26 (46.4)	56 (39.4)	
Education (years)				0.098
≥ 12	44 (63.8)	25 (36.2)	69 (49.6)	
9–12	20 (44.4)	25 (55.6)	45 (32.4)	
< 9	12 (48.0)	13 (52.0)	25 (18.0)	
Marital status				0.861
Marriage/consensual union	50 (53.8)	43 (46.2)	93 (66.4)	
Other	26 (55.3)	21 (44.7)	47 (33.6)	
Monthly household income (MW)				0.947
≥ 5	21 (56.8)	16 (43.2)	37 (27.2)	
3–5	36 (55.4)	29 (44.6)	65 (47.8)	
< 3	20 (58.8)	14 (41.2)	34 (25.0)	
Child				
Period				0.594
Morning	31 (52.5)	28 (47.5)	59 (41.9)	
Afternoon	46 (58.2)	33 (41.8)	79 (56.0)	
Full time	1 (33.3)	2 (66.7)	3 (2.1)	
Sex				0.801
Male	41 (53.9)	35 (46.1)	76 (53.6)	
Female	37 (56.1)	29 (43.9)	66 (46.4)	
Body mass index (percentile)				0.653
≤ 85	59 (57.3)	44 (42.7)	103 (72.5)	
85–97	7 (50.0)	7 (50.0)	14 (9.9)	
> 97	12 (8.5)	13 (9.1)	25 (17.6)	
Food consumption				
Beans				0.584
Yes	42 (57.5)	31 (42.5)	73 (51.8)	
No	36 (52.9)	32 (47.1)	68 (48.2)	
Fruits				**0.008**
Yes	46 (66.7)	23 (33.3)	69 (51.0)	
No	32 (44.4)	40 (55.6)	72 (49.0)	
Vegetables and pulses				0.557
Yes	31 (58.5)	22 (41.5)	53 (37.6)	
No	47 (53.4)	41 (46.6)	88 (62.4)	

Table 1 (*Continued*)

Characteristic	Sleep disturbance			*P*-value*
	No (54.9%)	Yes (45.1%)	Total (100.0%)	
	n (%)	n (%)	n (%)	
Hamburger and sausages				0.718
No	42 (56.8)	32 (43.2)	74 (52.5)	
Yes	36 (53.7)	31 (46.3)	67 (47.5)	
Sugary drinks				0.970
No	27 (55.1)	22 (44.9)	49 (34.8)	
Yes	51 (55.4)	41 (44.6)	92 (65.2)	
Instant noodles				0.484
No	45 (52.9)	40 (47.1)	85 (60.3)	
Yes	33 (58.9)	23 (41.1)	56 (39.7)	
Stuffed cookie				0.965
No	30 (55.6)	24 (44.4)	54 (38.2)	
Yes	48 (55.2)	39 (44.8)	87 (61.8)	

Abbreviation: MW, minimum wage (1 MW = US$ 207.00 in 2021).
*Chi-square test.
Bold values denote statistical significance at $p < 0.05$.

two exposures were not entered at once (►**Table 2**). Covariates with $p < 0.10$ were considered for inclusion in the adjusted model (Model 2) to identify independent predictors of sleep disturbances in children (►**Table 2**). Model 3 was adjusted for maternal education, maternal age, and child's sex, and Model 4 also included the child's BMI (►**Table 2**). The interaction between fruit consumption and the child's BMI was also tested (►**Table 2**).

We used the -2-log likelihood criterion to assess the goodness-of-fit of the models, with lower values denoting better fits. A p-value < 0.05 was considered statistically significant in all analyses.

Table 2 Fruit consumption as a determinant of sleep disturbances in children 9 years after delivery ($n = 142$). The PREDI study, Joinville, Brazil, 2021.

Characteristic	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[d]	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Fruit consumption								
Yes	Reference		Reference		Reference		Reference	
No	2.50 (1.26–4.95)	**0.009**	2.28 (1.14–4.57)	**0.020**	2.26 (1.12–4.54)	**0.023**	2.26 (1.12–4.56)	**0.023**
Fruit consumption + child's BMI								
Yes and ≤ 85th percentile	Reference		Reference		Reference		-	
No and ≤ 85th percentile	2.46 (1.09–5.52)	**0.029**	2.20 (0.97–4.99)	0.060	2.18 (0.96–4.98)	0.063	-	-
Yes and > 85th percentile	1.39 (0.46–4.25)	0.562	1.32 (0.43–4.03)	0.632	1.32 (0.43–4.05)	0.633	-	-
No and > 85th percentile	3.55 (1.23–10.27)	**0.019**	3.26 (1.23–9.54)	**0.031**	3.25 (1.09–9.67)	**0.034**	-	-

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.
Bold values denote statistical significance at $p < 0.05$.
[a]Model 1: Unadjusted odds ratio.
[b]Model 2: Adjusted for maternal education.
[c]Model 3: Adjusted for maternal education, maternal age, and sex.
[d]Model 4: Adjusted for maternal education, maternal age, sex, and child's BMI.

Results

Except for maternal age, there was no significant ($p < 0.05$) difference in maternal education years, monthly household income, marital status, birth weight, or child's sex between mothers/children enrolled at baseline and those considered losses in the 4th follow-up (Supplementary Material 1).

Of the 142 children included in the study, 64 (45.1%) had sleep disturbances. Fruit consumption was significantly ($p = 0.008$) associated with sleep disturbances (►**Table 1**). Among children who reported not to consume fruits, 55.6% had sleep disturbances (►**Table 1**).

The median total sleep score and interquartile range were 38 (15.0). Regarding the sleep disturbance subscales, 22 (15.5%) and 17 (12.0%) children were classified as having sleep-disordered breathing and sleep hyperhidrosis, respectively (►**Table 3**). The other four sleep disorders were observed in less than 2% of the children (disorders of initiating and maintaining sleep and disorders of excessive somnolence) or were not observed (disorders of arousal and sleep-wake transition disorders).

Unadjusted logistic regression analysis showed that fruit consumption was significantly associated with sleep disturbance (►**Table 2**, Model 1). Children who reported not eating fruits were more likely to have sleep disturbances (►**Table 2**, Model 1; OR = 2.50, 95% CI: 1.26–4.95, $p = 0.009$) compared with children who did consume fruits. This result continued to be significant after the inclusion of the covariates maternal education, maternal age, child's sex, and child's BMI in the models (►**Table 2**, Model 4; OR = 2.26, 95% CI: 1.12–4.56, $p = 0.023$). Regarding the interaction between *fruit consumption* and *child's BMI*, unadjusted analysis showed a significant increase in the odds of children who reported not to eat fruits having sleep disturbances as the child's BMI progressed to a higher category (►**Table 2**, Model 1; OR = 2.46, 95% CI: 1.09–5.52, $p = 0.029$; OR = 3.55, 95% CI: 1.23–10.27, $p = 0.019$ for *no fruit consumption and child's BMI* $\leq 85^{th}$ *percentile* and *no fruit consumption and child's BMI* $> 85^{th}$ *percentile*, respectively). The results did not change substantially even after adjustment for maternal education, maternal age, and child's sex (►**Table 2**, Models 2 and 3).

Discussion

In the present study, fruit consumption had a protective effect on sleep disturbances in children aged 9 years even after adjustment for other important maternal and child covariates. Regardless of the child's weight status, the lack of fruit consumption was found to be a determinant predictor for the development of sleep disturbances in children.

Sleep quality is a combination of different factors and has implications for physical and emotional health.[16] Sleep disturbances affect the quality of life of many people but are still underrecognized diseases.[17] In parallel, nutrition can affect hormones and inflammation status, factors that directly or indirectly contribute to sleep disturbances.[17] Within this context, the relationship between sleep quality and diet quality has an important effect on the individual's life and should be further investigated.[18,19]

Although studies have reported a link between sleep and diet, it is unknown whether it is sleep that affects dietary intake or the opposite. Our results agree with studies that found a positive association between the consumption of a high-fiber diet and adequate sleep quality.[18–20] Some authors reported that inadequate sleep has a detrimental effect on food choices and intake, leading to a vicious cycle of poor sleep, while improvements in sleep quality can improve food preferences and consumption.[18,21] Consuming an inadequate diet further deteriorates sleep and overall health.[18,21] On the other hand, a positive cycle involving healthy eating patterns promotes better sleep quality,[18] including a lower obstructive sleep apnea risk in adults.[22]

Studies have reported an association between the consumption of inadequate foods such as processed food and sleep-related problems.[4,5,23] Other authors found that low consumption of fruits and vegetables was associated with short sleep duration.[21] A study involving ∼ 70,000 Greek children revealed an association of insufficient sleep duration with unhealthy dietary habits such as skipping breakfast, fast-food consumption, and regular consumption of sweets, as well as with being overweight/obese.[24]

The interaction between diet and sleep is complex and there are many factors that can be associated with sleep

Table 3 Sleep disturbance subscales in children aged 9 years ($n = 142$). The PREDI study, Joinville, Brazil, 2021.

Subscale	Score	Sleep disturbance	
		No	Yes
	Median (IQR)	n (%)	n (%)
Disorders of initiating and maintaining sleep	10.0 (5.0)	140 (98.6)	2 (1.4)
Sleep-disordered breathing	3.0 (2.0)	120 (84.5)	22 (15.5)
Disorders of arousal	4.0 (2.0)	142 (100.0)	0 (0)
Sleep–wake transition disorders	10.0 (6.0)	142 (100.0)	0 (0)
Disorders of excessive somnolence	7.0 (4.0)	141 (99.3)	1 (0.7)
Sleep hyperhidrosis	2.0 (2.0)	125 (88.0)	17 (12.0)
Total sleep disturbance score	38 (15.0)	78 (54.9)	64 (45.1)

Abbreviation: IQR, interquartile range.

habits and food consumption.[4] We believe that clinical evidence regarding the association between diet and sleep is limited because of differences in the participants investigated (age, ethnicity, food culture), study designs, and methods used to assess sleep and diet. The drastic change in eating habits in recent years has led to the excessive consumption of ultra-processed foods[25] that are rich in preservatives and stabilizers and are associated with inflammatory processes.[7] The inflammatory process, in turn, is associated with sleep problems.[26] Although in our study sleep disturbances were not associated with the consumption of processed and ultra-processed foods, some studies have shown that long-term nutritional factors can alter the inflammation status,[27] which is also closely related to sleep problems.[26]

Sleep disturbances are related to alterations in circulating inflammatory cytokines such as C-reactive protein[26,28] and interleukin 6.[28] Some authors have demonstrated the protective effect of fruit consumption on sleep-related problems in adults,[23] adolescents,[5] and children.[4,24] Since fruits are rich in bioactive substances with antioxidant function and with a protective effect on inflammatory processes, including vitamins C and E, Mg, K, folic acid, and phytochemicals,[22,27] it seems coherent that the long-term non-consumption of fruits can cause sleep problems, among other illnesses. Indeed, sleep-disordered breathing has been associated with oxidative stress.[29] Ingesting antioxidants can decrease reactive oxygen species and delay the development of systemic oxidative damage, thus preventing sleep-disordered breathing.[30] Within this context, vitamin C present in most citrus fruits and vegetables was found to protect the brain against memory impairment[31] and sleep deprivation.[32]

Sleep interruption can influence food intake through non-homeostatic mechanisms, such as hedonic feeding, impaired decision making, emotional stress and obesogenic environment, and through homeostatic mechanisms such as changes in hunger hormones (increased ghrelin and decreased leptin secretion).[10] On the other hand, the consumption of fruits and vegetables may influence sleep through the polyphenol content of these foods mediated by different potential pathways.[10] One potential mechanism whereby polyphenols from fruits and vegetables may affect sleep measures is the gut-brain axis via serotonin and GABA receptors that affect nocturnal melatonin secretion.[10]

Finally, nutritional aspects vary significantly among populations with different diet patterns and depend on the digestive function of each individual.[17] Nutrition can also significantly alter the commensal microbiota, which may affect the metabolic generation of metabolites[33]; hence, the diet is partially responsible for microbiota homeostasis, and short-term changes in the dietary pattern can alter its diversity and composition.[34] Although we only observed an association between sleep and fruit consumption, we believe that fruit consumption triggers the consumption of other healthy foods such as vegetables. Consequently, this fiber-rich diet helps establish a beneficial microbiota.[19] Promoting a beneficial gut microbiota through the consumption of fiber-rich foods could be a useful tool to explore the role of the gut-brain axis in sleep quality and disorders.[20] Taken together, these findings highlight the importance of adequate food consumption for the child's sleep quality and the need for new studies, especially longitudinal ones, to better understand the causal relationship between food consumption and sleep disturbances. Finally, fruit consumption is part of a balanced diet and contributes positively to weight control. Our results make an additional contribution by showing that, regardless of BMI, fruits are a protective factor against sleep problems in childhood. The presence of caregivers in the children's routine must also be emphasized. Providing children with a balanced diet during childhood involves the maintenance and organization of the child's habits and routines. We believe that caregivers of children who consume fruits may be more concerned about the child's health and nutrition, thus contributing to better habits of children to enhance their quality of life.

Our study has important strengths. The data came from a longitudinal study that involved mother-child pairs and are primary data, a fact providing opportunities for future research in this field that is still unexplored in children. The possibility to adjust for important maternal and child covariates is another important strength of the study.

Some limitations of this study must be mentioned. First, variables such as food consumption, sleep data, education years, and household income were self-reported and are, therefore, vulnerable to reporting bias. Second, although the SISVAN questionnaire is a useful tool to collect information on the food consumption of the Brazilian population, it has some limitations. This questionnaire provides information on food consumption, but it is not a direct marker of food quality. Other factors, such as the variety of foods consumed, the presence of essential nutrients, and the balance between the different food groups, must be considered to assess the quality of food. However, in view of the design of our study, we chose to use this questionnaire because it is quick and practical to assess food consumption in the homes of study participants. Third, the data were collected during the coronavirus disease 2019 (COVID-19) pandemic, a fact that may have altered the children's food intake. Finally, the cross-sectional design of the study does not allow causal conclusions to be drawn.

Conclusion

Our study showed that not eating fruits was associated with the presence of sleep disturbances in children aged 9 years. We believe this information to be important considering that most populations in the world have shifted to an inadequate consumption of healthy foods, especially children. New studies using longitudinal data of children will be essential to understand the relationship between food consumption and sleep quality.

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Conflicts of Interests

The authors declare no conflict of interests.

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