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ORIGINAL ARTICLE

Not all adolescents are sleep deprived: A study of rural populations

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Abstract

The objective of this study was to investigate the role of environmental factors in sleep duration among adolescents living in rural areas. A total of 1140 students (569 males), aged 10–19 years, and attending two schools in rural regions in southern Brazil, completed a questionnaire about their sleep habits. Demographic data were also obtained. Prevalence ratios (PR) were estimated for the cases of more than 9 h of sleep on weekdays. Sleep duration in adolescents with and without electric lighting at home was analyzed. Average sleep duration at night was 9.63 (1.64) h on school-going days and 10.14 (2.42) h on weekends. The prevalence of adolescents sleeping for more than 9 h at night on school-going days was 58.3%. Older adolescents showed a tendency to delay their sleep onset times, which is associated with a reduction of sleep duration. Adolescents without electric lighting at home slept longer on school-going days ($P < 0.001$) and on weekends ($P = 0.013$) when compared to those with electric lighting at home. From multivariate analysis, age ($P < 0.001$), school schedule ($P = 0.007$) and work (0.042) were factors affecting sleep duration. In contrast to the data previously reported for urban populations, we found a high prevalence of adolescents sleeping for more than 9 h on school nights. Data on populations living in less industrialized regions reinforce the idea that technological advances are associated with the negative impact of sleep phase delay in adolescents.

Key words: adolescents, rural populations, sleep, sleep duration, sleep–wake cycle.

INTRODUCTION

Sleep needs vary throughout development, from 15 to 18 h at birth to around 9 h on an average during adolescence. This reduction in sleep duration occurs in parallel with an increase in a propensity to sleep during the daytime.[1–3] Additionally, adolescents show a phase delay in sleep–wake patterns throughout puberty development, which has been associated with environmental, behavioral and biological factors.[4–11] Sleep phase delay, early school starting times and the association between working and studying have been described as the main causes of a high prevalence of insufficient sleep in adolescents.[12–17] The consequent reduction in sleep duration might lead to reduced learning skills and daytime sleepiness, as well as metabolic, cardiovascular and breathing disturbances.[18–21]

Most of the studies claiming that adolescents do not get enough sleep are either based on data from urban populations[4,5,14,20,22] or do not report on the differences between urban and rural populations.[23] There are few studies discussing urban influences on sleep patterns in

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this age bracket.[24,25] Adolescents living in non-urban environments had earlier bedtimes on school days and weekends than the urban adolescents.[26] In a study on 37 adolescents, those without electric lighting at home slept approximately one hour longer at nights on school days than those with electric lighting at home, living in the same region and having the same school schedules.[27] Although this result suggests the absence of sleep deprivation in this population, the sample was relatively small and the study was conducted at only one rural site. For this reason, the present study aims to depict the role of social factors on sleep duration in a large population of adolescents who live in two rural areas.

PARTICIPANTS AND METHODS

A sample, 1140 adolescents (569 males and 571 females), with an average age of 13.83 (2.09) years for males and 13.55 (2.08) years for females, living in two rural areas in Southern Brazil, was studied cross-sectionally. The survey was carried out in two schools between 2003 and 2004. In those schools, adolescents followed one of the three following school schedules: morning (from 07.00 to 12.00), afternoon (from 13.00 to 18.00) and evening (from 18.00 to 23.00).

This study was approved by the Federal University of Parana Ethics Committee. Parental consent and adolescent assent were obtained before questionnaire completion. Adolescents voluntarily completed a questionnaire which included sociodemographic information, usual school day/weekend bedtimes and wake times, technology usage, sedentary habits and work hours.[24]

Sleep duration was categorized into four groups (<6, 6–8, 8–9, and >9 h per night). Sleep variables were compared using Kruskal–Wallis and Wilcoxon tests. A Poisson regression was carried out to identify factors associated with high sleep duration (>9 h) on school nights. This analysis is recommended in cross-sectional studies with a binary outcome of approximately 20%.[28] The variables with $P < 0.25$ in the bivariate analysis were included in the multivariate analysis.[29]

RESULTS

The mean sleep duration at nights on school days was 9.63 (1.64) h. No differences were found between the two areas ($P = 0.311$), nor between males and females ($P = 0.591$). 23.9% of adolescents categorized themselves as workers (Table 1). The prevalence of adolescents who slept more than 9 h at nights on school days was 57.7% in the male group and 58.8% in the female group (Table 2).

Table 1 Characteristics of the adolescents

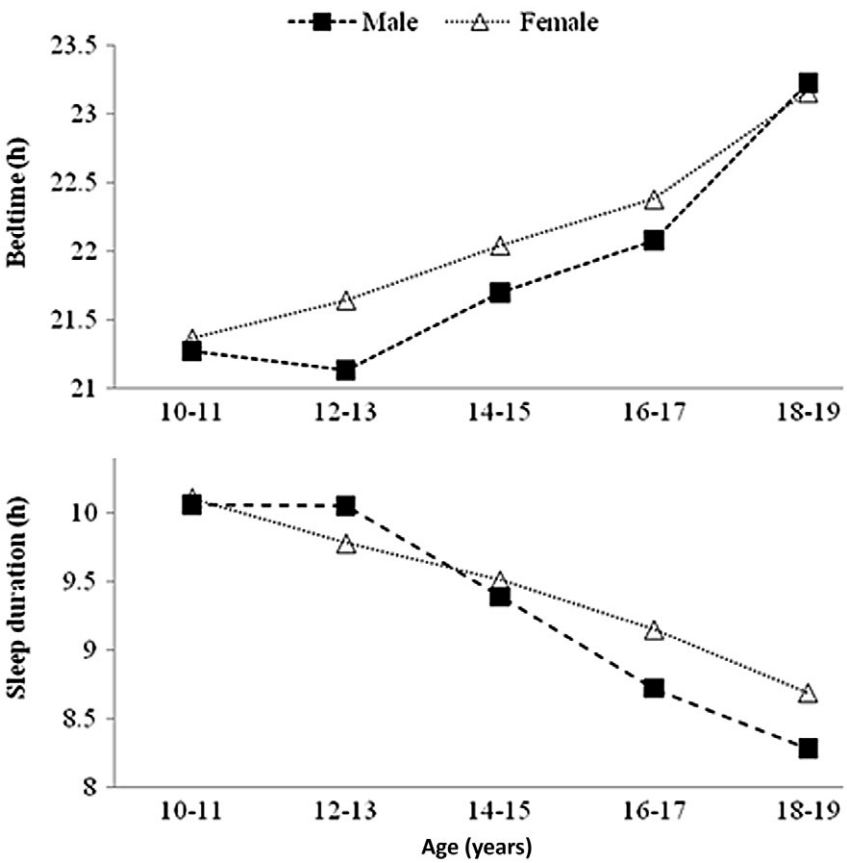
Variable	*n*	%
Age (years)		
10–11	43	3.8
12–13	144	12.6
14–15	352	30.9
16–17	394	34.6
18–19	207	18.2
Gender		
Male	569	49.9
Female	571	50.1
Electric lighting at home		
Yes	1103	96.8
No	37	3.2
People in bedroom		
One person	636	56.6
More than one person	487	43.4
TV at home		
Yes	976	86.3
No	155	13.7
Phone at home		
Yes	426	37.8
No	701	62.2
Internet at home		
Yes	38	3.4
No	1095	96.1
Active commuting to school		
Yes	337	29.7
No	797	70.3
Worker		
Yes	272	23.9
No	866	76.1

A tendency to a delay in sleep onset times and a reduction in sleep duration with increasing to age was observed (Fig. 1). The average values for sleep duration on school days, 9.6 (1.63) h, were significantly different for the students with electric lighting at home than those without 10.67 (1.41) h. The effect of having electric lighting at home on sleep duration was also observed on the weekends, with values of 10.12 (2.42) h and 10.66 (2.31) h of sleep, respectively ($P = 0.013$) (Fig. 2). In addition, adolescents with electric lighting at home slept less at night on school days than on weekends ($P < 0.001$). This difference was not seen in adolescents without electric lighting at home.

Table 2 Sleep characteristics of males and females

Variable	Male	Female	*P*-value
Sleep duration (school days), h	9.60 (1.70)	9.67 (1.58)	0.591
Sleep duration (weekend days), h	9.82 (2.62)	10.46 (2.17)	<0.001
Sleep duration (school days), %			
<6 h	1.8	0.7	0.104
6–8 h	21.2	18.0	0.081
>8 h	19.3	22.5	0.183
>9 h	57.7	58.8	0.703
Sleep duration (weekend days), %			
<6 h	4.4	0.7	<0.001
6–8 h	15.5	9.5	0.003
>8 h	18.8	12.9	<0.001
>9 h	61.3	76.8	<0.001
Bedtime (school days)	21.31 (3.51)	21.38 (3.40)	0.457
Bedtime (weekend days)	22.29 (4.07)	22.24 (3.47)	0.378
Wake time (school days)	7.32 (1.67)	7.43 (1.68)	0.044
Wake time (weekend days)	8.55 (1.98)	8.97 (1.71)	<0.001

†Data are expressed as mean (standard deviation) or percentage. ‡*P*-values for comparison across sleep duration categories are the chi-square for categorical variables and the Kruskal–Wallis for continuous variables.



Figrue 1 Sleep duration and bedtime on school days compared to age (2-year interval).

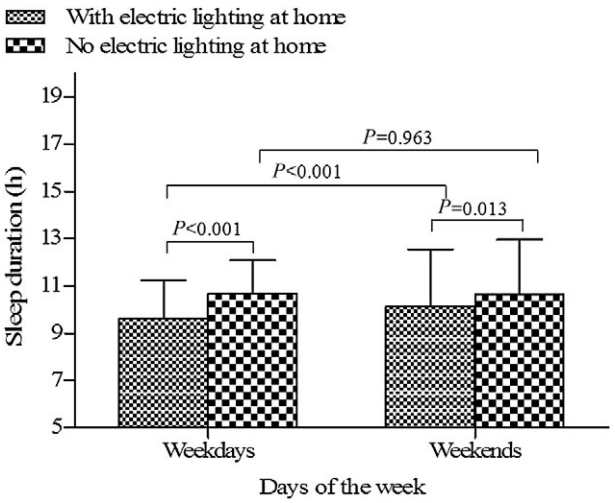


Figure 2 Sleep duration of the adolescents with and without electric lighting at home.

The analysis of the prevalence of causes identified the factors associated with sleep duration greater than 9 h on school days (Table 3). In the bivariate analysis, age ($P < 0.001$), electric lighting at home ($P = 0.011$), school schedule ($P < 0.001$), TV at home ($P = 0.003$) and working ($P < 0.001$) were factors associated with sleep duration in adolescents. The prevalence of "long sleepers" in the group without electric light at home was 79.4%. In the age-adjusted analysis, school and work were the variables consistently associated with sleep duration. After adjustment for confounding variables, the younger adolescents slept longer. The adolescents who were on afternoon and night schedules also slept longer. The prevalence of long sleepers among non-working adolescents was 1.23 times higher (IC 95%: 0.99–1.52) than for the working group.

DISCUSSION

The study offered a rare opportunity to investigate the biological and environmental influences on a large sample of students exhibiting important characteristics related to sleep behavior during adolescence. The results showed a high prevalence of sufficient sleep duration among adolescents living in two rural areas and also confirmed the hypothesis that the availability of electrical lighting contributes to chronic sleep deprivation in these adolescents. The results do not follow the trend observed in previous studies carried out in urban populations that showed reduced sleep duration, especially on school days.[15,16,23,30–34] For example, in contrast to our results, Perez-Chada *et al*.[35] found 50% of urban adolescents got less than 8 h of sleep on school days.

In the present study, the prevalence of adolescents who sleep more than 9 h a night was lower among working adolescents. This association between working and short sleep duration had already been reported.[8,9,16,27] In addition, earlier waking and poor sleep quality among those adolescents who worked were also found.[16] Nevertheless, we did not find significant differences between males and females, as were observed in the above-mentioned study.[16]

As observed in previous studies, the use of media devices and electric lighting at home were also associated with short sleep duration.[26,27] Our findings could be partially explained by the association between long sleep duration and early bedtimes. Bedtime seems to be related to the availability of electronic devices, which is only possible among the adolescents with electric lighting at home. Peixoto *et al*.[27] observed that adolescents with electric lighting at home had later bedtimes as compared to those without electric lighting at home.

Many studies have shown that adolescents sleep less on school days.[18,35–39] However, only adolescents with electric lighting at home showed a difference between school days and weekends. Adolescents without electric lighting at home showed similar sleep duration when school days and weekend days were compared, suggesting an important effect of environmental factors on sleep patterns.

The results showed a high prevalence of long sleep duration among rural adolescents. In addition, increased age was found to correspond to later sleep times. Thus, it is possible to observe, in our data, the combined effects of the use of media devices and the pubertal stage on sleep delay.[4,5,18,19,23] Based on this data, one would expect that the sleep deprivation observed in adolescents faced with early school schedules would be more evident in older adolescents, reflecting an interaction between biological and environmental factors in the sleep–wake cycle.

In summary, our data make important contributions to a better understanding of adolescents' sleep behavior. Delay of sleep times occurs in both urban and rural populations, but its impact on sleep duration depends on environmental factors. The presence of electric lighting at home is an important factor related to short sleep duration and sleep irregularity in adolescents. Social demands, such as school schedules and work, also had an important influence on sleep duration in the population studied.

Table 3 Prevalence and prevalence ratio (PR) considering sleep duration >9 h as dependent variable

Variable	Prevalence (%)	Not adjusted†		Adjusted‡	
		PR (95% CI)	*P*	PR (95% CI)	*P*
Age (year)			<0.001		<0.001
10–11	70.2	1.91 (1.19–3.09)		1.73 (0.90–3.29)	
12–13	67.7	1.84 (1.14–2.97)		1.70 (0.90–3.22)	
14–15	50.4	1.37 (0.85–2.23)		1.28 (0.67–2.43)	
16–17	38.8	1.06 (0.63–1.77)		0.99 (0.50–1.95)	
18–19	36.7	1.00		1.00	
Gender			0.703		
Male	57.7	1.00			
Female	58.8	1.02 (0.92–1.13)			
Electric lighting			0.011		0.317
With	57.6	1.00		1.00	
Without	79.4	1.38 (1.15–1.65)		1.22 (0.80–1.86)	
School schedule			<0.001		0.007
Morning	40.3	1.00		1.00	
Afternoon	57.1	1.42 (1.12–1.79)		1.27 (0.93–1.75)	
Night	64.9	1.61 (1.27–2.03)		1.52 (1.10–2.11)	
People in bedroom			0.341		
One person	56.8	1.00			
More people	59.7	1.05 (0.94–1.16)			
TV at home			0.003		0.169
Yes	56.4	1.00		1.00	
No	69.1	1.22 (1.09–1.38)		1.16 (0.92–1.45)	
Phone at home			0.094		0.470
Yes	54.9	1.00		1.00	
No	60.0	1.09 (0.98–1.22)		1.05 (0.89–1.24)	
Internet at home			0.879		
Yes	57.1	1.00			
No	58.4	1.02 (0.76–1.37)			
Active commuting to school			0.513		
Yes	58.9	1.04 (0.92–1.16)			
No	56.7	1.00			
Worker			<0.001		0.042
Yes	44.9	1.00		1.00	
No	62.2	1.38 (1.20–1.60)		1.23 (0.99–1.52)	

†*P*-value not adjusted chi-square. ‡*P*-value adjusted.

Our study reinforces the idea that technological advances are associated with sleep delay in adolescents. According to the results, any interventions to minimize the impact of sleep delay on the adolescent should prioritize the more susceptible groups: older and/or working adolescents who use technology. Further analyses with other variables, such as excessive diurnal sleepiness and its associated factors, in urban and rural populations would allow the implementation of more effective countermeasures in order to avoid adolescent sleep deprivation.

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