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SLEEP QUALITY OF ADOLESCENTS DURING THE COVID-19 PANDEMIC AND ASSOCIATED FACTORS

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ABSTRACT

This study sought to evaluate the quality of sleep of adolescents during social isolation by pandemic COVID-19 and associated factors. This is a cross-sectional study, carried out with 287 adolescents. Self-rated sleep quality was analyzed according to sociodemographic profile, nutritional status, self-perception of health and body image, physical activity, time in front of the television, and food intake. Prevalence ratios (PR) and 95% confidence intervals (95%CI) were estimated using multiple Poisson regression models with robust variance. The prevalence of adolescents with self-reported poor sleep was 33.5%. It was observed that female adolescents (PR=1.14; 95%CI: 1.05-1.23), with a negative perception of their health (PR=1.19; 95%CI: 1.10-1.30) and insufficiently active (PR=1.08; 95%CI: 1.00-1.17) were associated with poor sleep quality. The results indicate a high prevalence of adolescents who self-rated their quality of sleep as poor during the COVID-19 pandemic. Sleep quality was influenced by biological factors (such as gender) and behavioral factors (such as physical inactivity, and negative health perception).

INTRODUCTION

During the adolescent period, the individual undergoes major changes, and are easily affected by external factors, such as public health emergencies (Zhai *et al.*, 2021). The Coronavirus disease pandemic (COVID-19) is having a negative, long-term impact on the physical and mental health of adolescents (Helito *et al.*, 2021; Genta *et al.*, 2021; Zhu *et al.*, 2021). The temporary closure of schools and public spaces has brought about changes in adolescents' lifestyles, such as the interruption of usual daily activities, exacerbating symptoms of anxiety, depression, and post-traumatic disorders, decreasing physical activity, and increasing sedentary behavior (Dalton, Rapa & Stein, 2020; Malta *et al.*, 2021). Furthermore, studies show that the pandemic had repercussions on the sleep pattern of adolescents, due to the lack of face-to-face classes, increased leisure time, and increased use of electronic devices. Despite the increased time in bed, worse sleep quality has been reported among adolescents (Silva *et al.*, 2022; Genta *et al.*, 2021; Zhai *et al.*, 2021). Inadequate sleep is considered a public health problem worldwide (Chattu *et al.*, 2018). Both short and long sleep duration are significant predictors of death from all causes (Cappuccio *et al.*, 2010). Poor sleep quality increases the risk of obesity, cardiovascular, metabolic conditions, mood and cognitive problems (Wang *et al.*, 2020; Ranjbar *et al.*, 2021; Islam *et al.*, 2021). In this context, in view of the impact caused by the pandemic on adolescents' social and behavioral habits, and the importance of sleep for health during adolescence, assessing adolescents' self-perception of sleep quality during the COVID-19 pandemic and the factors associated with poor sleep quality potentiate public health measures to improve adolescents' health and quality of life.

In this regard, the aim of this study was to evaluate adolescents' self-perceived sleep quality and associated factors during social isolation by the COVID-19 pandemic.

METHODS

This is a descriptive cross-sectional quantitative study, approved by the Research Ethics Committee of the State University of Montes Claros-Minas Gerais under opinion number 5.105.614/2021. The study was conducted with adolescents enrolled in elementary school II in public schools in the north of Minas Gerais, Brazil. The sample was selected by convenience in a non-probabilistic and intentional way. Included in the study were regularly enrolled students who had no diagnosed mental or eating disorders, who owned an electronic device with Internet access, and who agreed to participate voluntarily in the research. Adolescents who answered the forms incorrectly were excluded. Given the pandemic situation, data collection was carried out in a virtual format. Initially, a letter presenting the study was sent via e-mail to the directors of municipal secretariats and state schools, requesting permission to carry out the research, and inviting them to collaborate with the study by sending a link to parents and adolescents in their respective school communities. The directors and/or teachers of the schools that agreed to collaborate with the study sent a link via @Whatsapp to the parents and/or guardians containing an informed consent form (ICF), with explanations about the study, contacts for clarification about the research, and the request for consent for participation of the minor under their responsibility. To authorize or not the minor's participation, the parents registered their consent through an online software by Google Forms.

After parental consent, the student received an informed consent form online, where they registered their consent to participate in the study on a voluntary basis. After that, the adolescents started to fill out a structured, self-administered questionnaire divided into thematic modules. The participants' answers are anonymous and confidential; moreover, the participants could stop participating in the study and exit the questionnaire at any stage before the submission process, where their answers would not be saved. The dependent variable of the study was self-rated sleep, assessed based on the question "How do you rate the quality of your sleep? Would you say it is: excellent/very good; good; regular; poor; very poor?" For analysis purposes, this variable was recategorized into bad (bad and regular) and good (good, excellent/very good) sleep quality (Barros et al., 2019). As independent variables, questions regarding the sociodemographic profile (gender and age) and behavioral profile (nutritional status, body weight behavior, self-perception of health and body image, physical activity, time in front of television (TV), and food consumption) of adolescents were collected. To analyze the behavior of body weight during the pandemic, the following question was asked: How do you consider the change in your body weight since the beginning of social isolation? Having as response options: (remained my body weight; decreased my body weight; or increased my body weight). Being categorized into remained or decreased and increased.

Self-perception of health was assessed by the following question: how do you rate your health status? With four response categories between "very good," "good," "regular," and "bad," which were subsequently dichotomized into positive (for the "very good" and "good" options) and negative (for the "regular" and "bad" options) (Silva, Rocha, and Caldeira, 2018). To identify the self-perception of body image, the Thompson & Gray Silhouette Scale (ES) was used, created by Thompson and Gray (1995), and validated for Brazilian adolescents of both genders by Conti and Latorre (2009). The scale consists of 18 figures (nine female and nine male), whose size and weight increase gradually from thinner to obese. The adolescents are asked to indicate which figure represents their current body and the one that corresponds to the body they want to have/be. To evaluate the practice of physical activity, the practice during social isolation was questioned: During social isolation, did you practice some type of PA (yes, no), how much time do you spend doing PA per day?

how many times a week? For analysis purposes, the time spent doing PA per day was multiplied by the number of times per week and then characterized as: sufficiently active (≥300 min/week) and insufficiently active (<300 min/week) (WHO, 2020). The change in physical activity practice during social isolation was asked: How did you consider the change in physical activity practice since the beginning of social isolation? and was categorized as: increased or remained and decreased practice. The time spent daily (in hours) watching TV during the week and on weekends was evaluated. The adolescents answered the following questions: "How much time per day do you usually watch TV on weekdays?", "And on weekends (Saturday and Sunday)?". Based on this information, we calculated the average number of daily hours devoted to this type of activity [(total hours on the weekend + hours during the week x 5)/7]. Amount of time greater than 4 h/day was considered as excessive time in front of TV (Mielke et al., 2018). The consumption of ultra-processed foods was characterized according to the weekly frequency (days/week) of ingestion of processed/ultra-processed foods such as hamburger, ham, mortadella, salami, sausage, sausage, instant noodles, packaged snacks, salty snacks and soft drinks.) The question had the following structure: "In the last 7 days, on how many days did you eat (name of the food group)? [I did not eat (food) in the past 7 days | 1 day in the past 7 days | 2 days in the past 7 days | 3 days in the past 7 days | 4 days in the past 7 days | 5 days in the past 7 days | 6 days in the past 7 days | every day in the past 7 days]". For the purposes of analysis, students reporting consumption for more than three days a week were classified as inadequate consumption of ultra-processed foods. The consumption of vegetables and fruits were also assessed, being considered adequate the consumption of at least one daily portion of fruits and vegetables (< 5 days/week | ≥ 5 days/week) (Maia et al., 2018). Statistical Package for the Social Sciences (SPSS) for Windows version 21.0 software was used to analyze the data. Initially, the characterization of the sample was performed through the simple and relative frequency distributions for all variables analyzed and the prevalence of overweight was estimated according to sociodemographic and behavioral factors. Next, bivariate analyses were performed by means of associations between the independent variables and sleep quality. The magnitude of the associations was estimated by crude prevalence ratios with their respective 95% confidence intervals. For this purpose, a Poisson regression model with robust variance was adopted. The variables that presented a descriptive level (p-value) ≤ 0.25 were selected for multiple analysis, where only those variables that presented a descriptive level p<0.05 remained in the final model.

RESULTS

A total of 287 adolescents participated in the study, 60.3% female and 39.7% male, aged between 11 and 16 years. Table 1 presents the sociodemographic characteristics and behavioral factors of the adolescents (Table 1). In the self-assessment of sleep quality, 66.2% of adolescents consider their sleep quality as good and 33.5% as bad. In the crude analysis it was observed that poor sleep quality is associated with adolescents who are female (p=0.000), aged between 14 and 16 years (p=0.209), overweight/obese (p=0.243), report weight gain during the pandemic (p=0.207), with negative perception of their health (p=0.000), dissatisfied with their body image (p=0.145), insufficiently active (p=0.017), with decreased physical activity during the pandemic (p=0.018), and who spent more than four hours a day in front of the TV (p=0.026) (Table 2). Adolescents' eating behaviors showed no significant associations at the p<0.250 level with poor sleep quality. After adjustment, we observed that female adolescents (PR=1.14; 95%CI1.05-1.23), with a negative perception of their health (PR=1.19; 95%CI1.10-1.30) and insufficiently active (PR=1.08; 95%CI1.00-1.17) were more likely to have poor sleep quality during periods of social isolation.

DISCUSSION

Adolescent sleep was significantly impacted by the COVID-19 pandemic (Tyack et al., 2022).

Table 1. Characterization of the sample according to sociodemographic and behavioral factors of adolescents from northern Minas Gerais, Brazil (n=287)

Variables	Total	Quality of sleep	
		Good	Bad
	n (%)	n (%)	n (%)
Sociodemographic Factors			
Gender			
Male	114 (39.7)	90 (78.9)	24 (21.1)
Female	173 (60.3)	100 (57.8)	73 (42.2)
Age			
11 to 13 years	189 (63.8)	126 (68.9)	57 (31.1)
14 to 16 years	104 (36.2)	64 (61.5)	40 (38.5)
Behavioral Factors			
Body Mass Index			
Eutrophic	187 (65.2)	128 (68.4)	59 (31.6)
Overweight/obese	100 (34.8)	62 (62.0)	38 (38.0)
*Weightbehavior SD**			
Remainedordecreased	106 (36.9)	75 (70.8)	31 (29.2)
Increased	181 (63.1)	115 (63.5)	66 (36.5)
Perceptionofhealth			
Positive	198 (69.0)	149 (75.3)	49 (24.7)
Negative	89 (31.0)	41 (46.1)	48 (53.9)
Body Image			
Satisfied	99 (34.5)	71 (71.7)	28 (28.3)
Dissatisfied	188 (65.5)	119 (63.3)	69 (36.7)
PhysicalActivity			
Sufficientlyactive	100 (34.8)	75 (75.0)	25 (25.0)
Insufficientlyactive	187 (65.2)	115 (61.5)	72 (38.5)
*Physicalactivity SD**			
Remainedorincreased	143 (49.8)	104 (72.7)	39 (27.3)
Decreased	144 (50.2)	86 (59.7)	58 (40.3)
Time in front of TV			
≤3 hours/day	218 (76.0)	152 (69.7)	66 (30.3)
>4 hours/day	69 (24.0)	38 (55.1)	31 (44.9)
Ultra-processed food consumption			
Adequate	105 (36.6)	69 (65.7)	36 (34.3)
Excessive	182 (63.4)	121 (66.5)	61 (33.5)
Soft drink consumption			
Adequate	54 (18.8)	38 (70.4)	16 (29.6)
Inadequate	233 (81.2)	152 (65.2)	81 (34.8)
Snackconsumption			
Adequate	156 (54.4)	101 (64.7)	55 (35.3)
Inadequate	131 (45.6)	89 (67.9)	42 (32.1)
Vegetableconsumption			
Adequate	94 (32.8)	58 (61.7)	36 (38.3)
Inadequate	193 (67.2)	132 (68.4)	61 (31.6)

*SD: During the pandemic.

Table 2. Crude and adjusted prevalence ratio (PR) for poor sleep quality according to sociodemographic and behavioral factors of adolescents from northern Minas Gerais, Brazil (n=287)

Factors	RP (IC$_{95\%}$)	P-value	RP (IC$_{95\%}$)	P-value
	Crude		Adjusted	
Gender		0.000		0.002
Male	1.00		1.00	
Female	1.17 (1.08-1.27)		1.14 (1.05-1.23)	
Age		0.209		NS
11 to 13 years	1.00		-	
14 to 16 years	1.06 (0.97-1.15)		-	
Body Mass Index		0.243		NS
Eutrophic	1.00		-	
Overweight/obese	1.05 (0.96-1.14)		-	
*Weight behavior SD**		0.207		NS
Remained or decreased	1.00		-	
Increased	1.07 (0.97-1.15)		-	
Perception of health		0.000		0,000
Positive	1.00		1.00	
Negative	1.23 (1.14-1.34)		1.19 (1.10-1.30)	
Body Image		0.145		NS
Satisfied	1.00		-	
Dissatisfied	1.07 (0.98-1.16)		-	
Physical Activity		0.017		0.043
Sufficiently active	1.00		1.00	
Insufficiently active	1.11 (1.02-1.21)		1.08 (1.00-1.17)	
*Physical Activity SD**		0.022		NS
Remained or increased	1.00		-	
Decreased	1.10 (1.02-1.19)		-	
Time in front of TV		0.026		NS
≤3 hours/day	1.00		-	
>4 hours/day	(1.11 (1.01-1.22)		-	

Note: PR: Prevalence ratio; NS: Not significant; 95% CI: Confidence interval; *SD: During the pandemic.

In this study, the prevalence of self-rated sleep quality as poor among adolescents assessed during social isolation by pandemic COVID-19 was 33.5%. Adolescents who were female, had negative health perceptions, and were insufficiently active were associated with high prevalence of poor sleep quality. The prevalence of adolescents with poor sleep quality in this study are lower compared to studies conducted before the COVID-19 pandemic in national (Cavalcanti *et al.*, 2021) and international studies (Moustakbal and Maataoui, 2022; Akçay and Akçay, 2018). During the pandemic, a study conducted by Zhai *et al.* (2021) observed a prevalence of poor sleep quality in Chinese adolescents of 18.6%. According to a study by Chen *et al.* (2022) 26.1% of the adolescents assessed indicated having lower sleep quality, while 21.6% had higher sleep quality than before the pandemic. Due to home isolation, adolescents did not have to wake up early to study as they did before the COVID-19 pandemic (Chen *et al.*, 2022). With this, sleeping and waking up at later times were observed in several studies (Sinha *et al.*, 2020; Cellini *et al.*, 2020; Gruber *et al.*, 2021). Although more flexible online school start times are beneficial for adolescents' sleep (Socarras *et al.*, 2021). This behavior during the pandemic could cause a decline in sleep quality, as cognitive-emotional arousal and behavioral habits, which are modifiable, influenced adolescents' sleep quality during the COVID-19 pandemic (Gruber *et al.*, 2021). This is of concern, as poor sleep in adolescence may negatively affect future metabolic health (Mathew *et al.*, 2022). The results of the adjusted analysis indicated an association between poor sleep quality and female gender. This difference in adolescent sleep quality between genders during the pandemic was also observed in studies conducted in Brazil (Silva *et al.*, 2022), China (Zhai *et al.*, 2021), Italy (Casagrande *et al.*, 2020), and Bangladesh (Islam *et al.*, 2021). A systematic review and meta-analysis noted that a high prevalence of sleep problems emerged during the COVID-19 pandemic and women are the most affected (Alimoradi *et al.*, 2021).

According to Silva *et al.* (2022) self-assessment and reporting of health problems are more frequent among women than men. In addition, adolescent girls are responsible for several household chores, which associated with school activities can generate stressors and thus develop poor sleep quality. Furthermore, girls may be more susceptible to sleep problems due to hormonal changes, such as during menstrual cycles (Barros *et al.*, 2019). In this study, we confirmed previous studies on the influence of physical inactivity on sleep quality in adolescents (Mahfouz *et al.*, 2020). It was observed that physically inactive adolescents had higher prevalences of poor sleep quality. Given that sleep and physical activity are modifiable behaviors, and better sleep minimizes daytime impairment (e.g., sleepiness, fatigue/energy), facilitating an active lifestyle (Pesonen *et al.*, 2022). Studies show that sleep quality, predicts physical activity behavior the next day (Pesonen *et al.*, 2022), and higher physical activity in a day is associated with higher sleep efficiency (Atoui *et al.*, 2021). A study of adolescents during the COVID-19 pandemic corroborates by showing that adolescents were more likely to sleep poorly when their physical activity levels decreased during the pandemic (Zhai *et al.*, 2021). The results indicated that self-rated health is significantly associated with adolescent sleep quality. This association found corroborates findings from previous studies (Ahmed *et al.*, 2020; Andreasson *et al.*, 2021; Islam *et al.*, 2021). Overexposure of impaired sleep quality, such as difficulty falling asleep or staying asleep for an extended period, is related to adolescent self-reported health and well-being (Marques *et al.*, 2019; Conklin *et al.*, 2019; Liu *et al.*, 2020; Andreasson *et al.*, 2021). The results of this study may assist in the formulation of public health strategies aimed at better sleep hygiene and behavioral changes of adolescents in this period of return to face-to-face schooling, and openness of public spaces. However, some limitations should be considered. Among the limitations of the study is the cross-sectional design, which does not allow establishing a causal relationship between the variables. We conducted the survey in this study by online questionnaire, which may result in a selection bias, especially by the use of convenience sampling. In addition, in this study self-perception of sleep quality was measured by a single question. However, it is noteworthy that the use of this method of assessing sleep quality has been used in several studies (Hoefelmann *et al.*, 2012; Barros *et al.*, 2019). Short scales to measure the physical and mental health of populations are increasingly used in epidemiological research (Ahmad *et al.*, 2014), and sleep quality assessment can help assess the impact that the COVID-19 pandemic has had on adolescent health.

CONCLUSION

A high prevalence of adolescents with a self-perceived poor sleep quality was found during the COVID-19 pandemic. Sleep quality was influenced by biological factors (such as gender) and behavioral factors (such as physical inactivity, and negative health perception). The importance of future studies evaluating sleep quality after the COVID-19 pandemic is highlighted.

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